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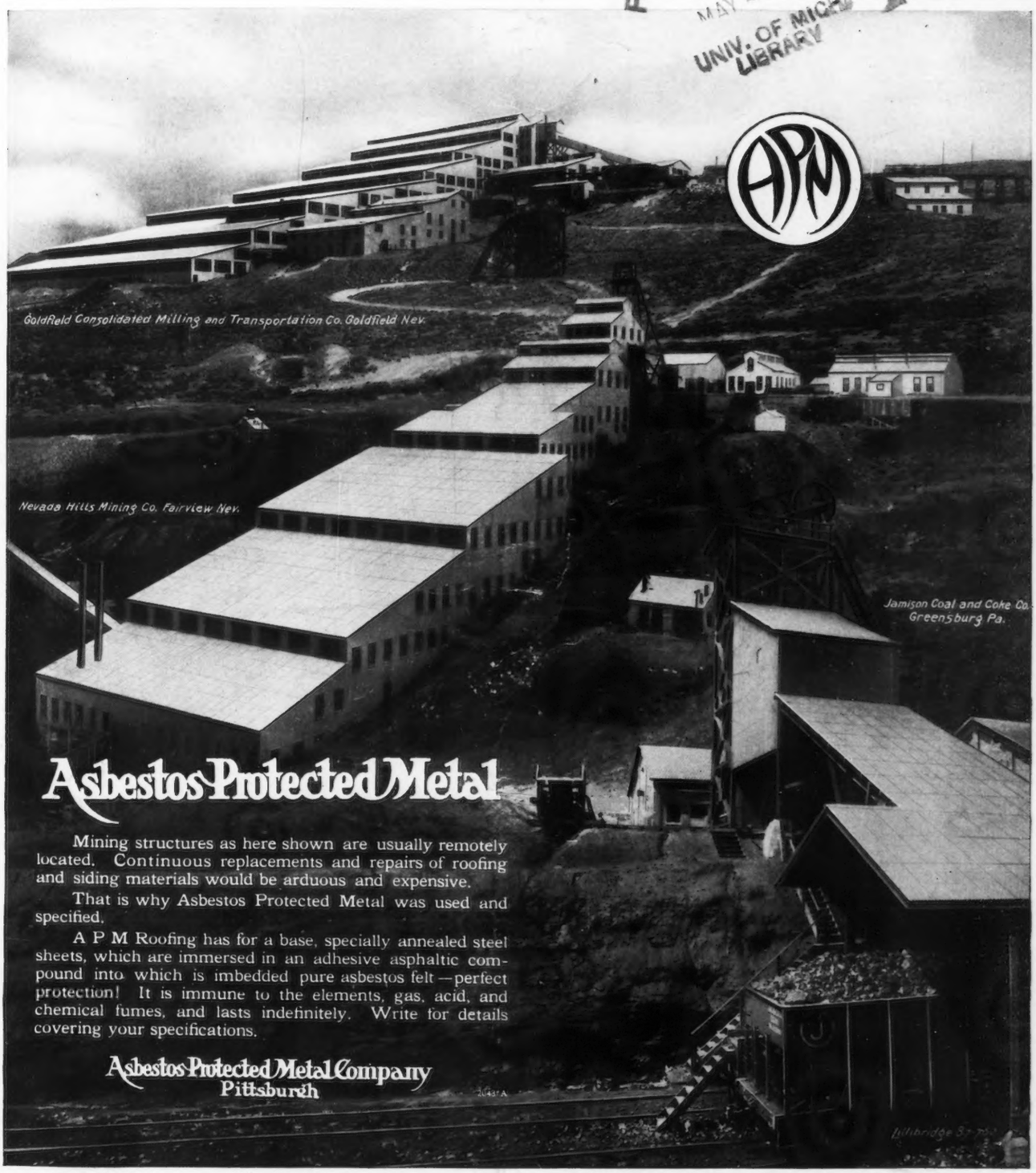
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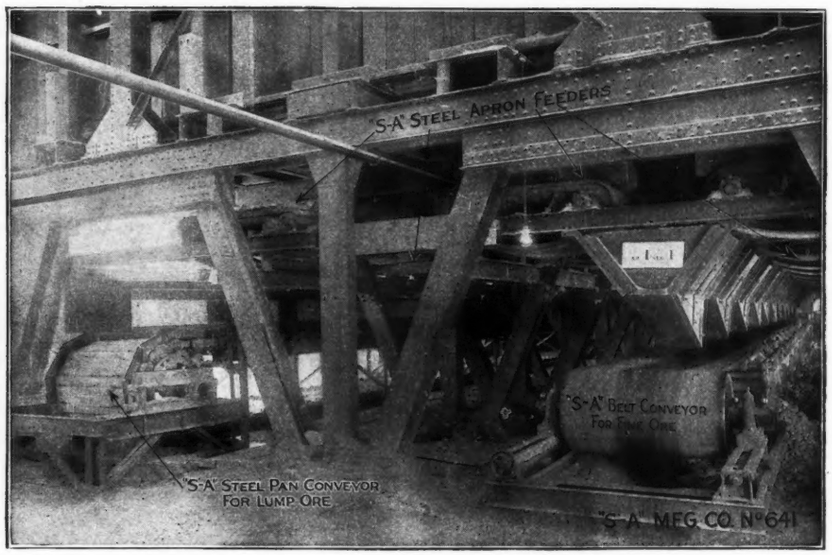

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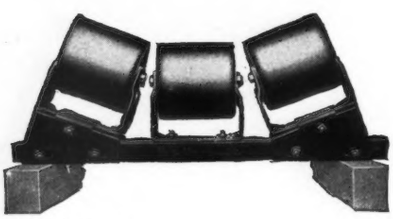

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The Engineering and Mining Journal

VOLUME 101 MAY 20, 1916 NUMBER 21

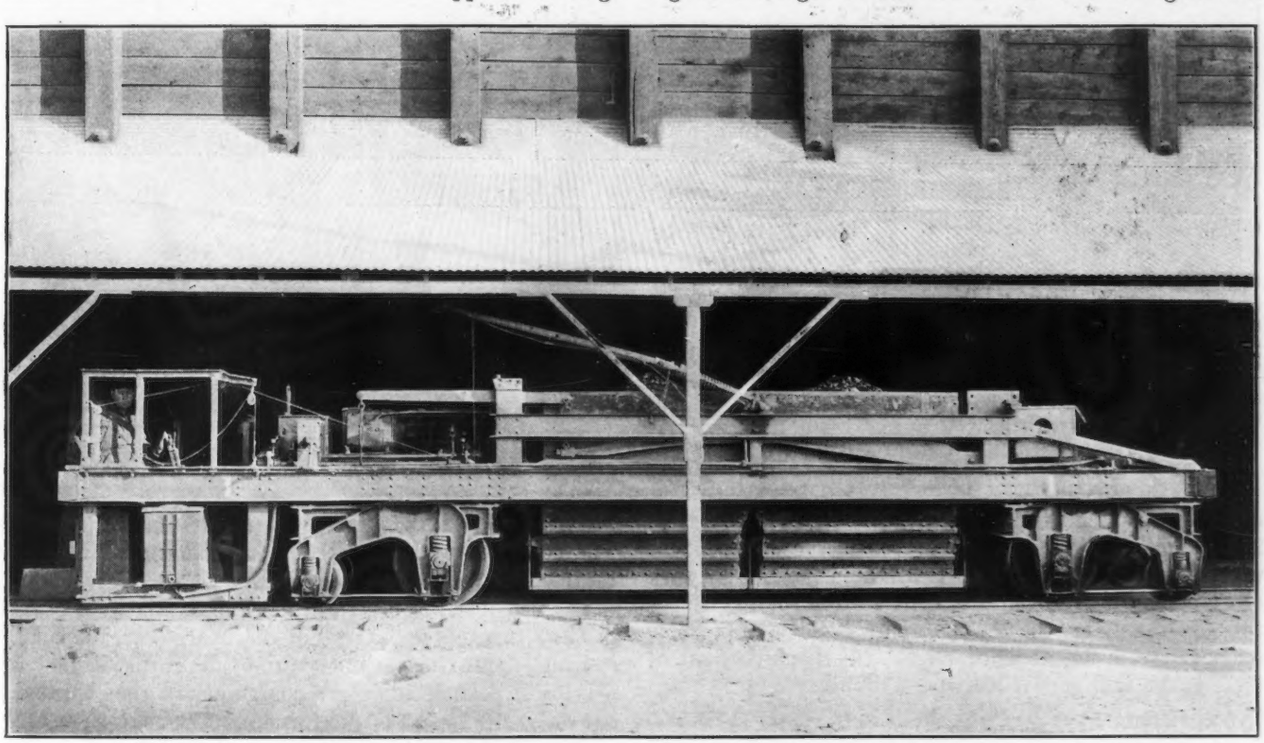
Mechanical Feeding as Applied to Silver-Lead Blast Furnaces

By L. Douglass Anderson*

SYNOPSIS—A general review of the application of mechanical feeding to blast furnaces, and recent improvement in making up the charges for silver-lead furnaces. The new system at Midvale, Utah, eliminated about 50 charge wheelers and improved the metallurgical work of the furnaces.

The importance of the correct feeding of blast furnaces has been well recognized by all metallurgists, particularly since long rectangular furnaces replaced the small round furnaces once used for lead and copper smelting.

With increase in size of the furnaces, it began to be realized that the full benefit of increased tonnage was not being reaped as long as the antiquated hand-feeding practice was maintained. This was true of all types of blast furnaces, whether ferrous or nonferrous. Consequently increase in size was soon followed by the development of many devices for proportioning the charge constituents and introducing them to the furnace with the minimum of hand labor. Coincindent with the use of these devices came bitter experiences in furnace irregularities until finally the underlying principles of correct furnace feeding were recognized and the mechanical-feeding devices



CHARGE-COLLECTING LARRY USED AT MIDVALE, UTAH

Indiscriminate dumping or shoveling of charges into the furnaces would be one of the surest means possible of bringing about bad furnace running. Hand feeding, still employed at many plants, has an advantage over mechanical feeding in that faulty conditions can be promptly rectified as they become evident. For this reason mechanical feeding with its rigid unchangeability has not been looked upon with general favor.

were so designed as to accomplish automatically what had been obtained through the older, more laborious and more costly method of hand feeding.

The various ingenious mechanisms now constituting the "tops" of modern iron furnaces are witnesses of this development. The development of mechanical feeding for nonferrous furnaces has been somewhat slower, but of late some noteworthy progress has been made which it will be the effort of this article to outline.

*Superintendent, United States Smelting Co., Midvale, Utah.

The practically universal round shape of the iron blast furnace as compared with the generally rectangular shape of copper and lead furnaces has made it necessary for the development of mechanical feeding to proceed along different lines. The copper furnace does not seem to be so sensitive as the lead furnace to the manner of its feeding, which is undoubtedly the reason why mechanical feed for the copper furnace was developed in advance of that for the lead furnace. But even here certain principles had to be borne in mind and the manner in which the charge was deposited carefully studied.

Developments in Feeding Copper Furnaces

At one copper-smelting plant fed from small V-shaped side-dumping cars, certain furnace irregularities proved extremely puzzling until it was discovered that the apron plates were making an extreme segregation of coarse and fine material. A simple change rectified this, and the irregularities disappeared. The far-famed long furnaces of Anaconda are fed from cars tilted by air cylinders in such a manner as to give just the right disposition of material in the shaft.

In addition to the manner in which the material is deposited in the furnace, the way in which the charge is made up and the various constituents weighed out is of importance, for the former is considerably dependent upon the latter. Here again it has been possible to work out economical arrangements more readily for the copper furnace than for the lead furnace. Some admirable schemes are in use at many plants. Perhaps the best of these is the well-known Messiter bedding system installed at Cananea, Bisbee, Clifton, etc.

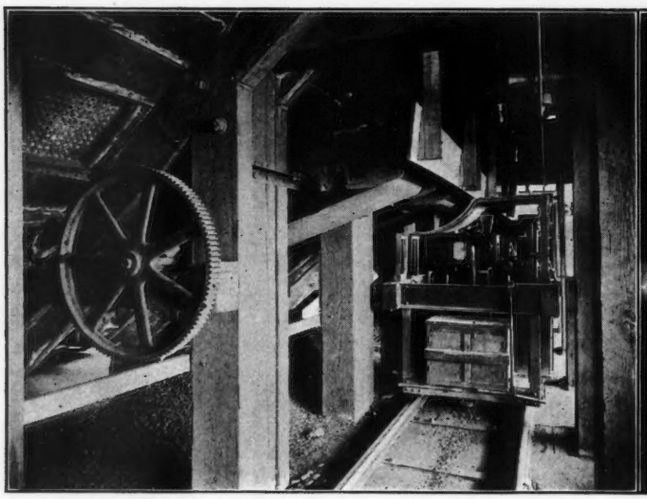
At the Mason Valley smelting works there was installed a clever and economical arrangement of individual weighing hoppers under the main bins. A scaler weighed out into the respective hoppers the requisite amounts of the various ingredients of the charge; the charge-train crew had then merely to run the charge cars under these hoppers, draw out the material already weighed, transport the train of cars to the furances, and dump.

At the Calumet & Arizona smelting works at Douglas is another excellent arrangement. Bins for holding the ingredients of the charge are arranged in rows parallel to the length of the furnaces. Under these bins are platform scales and a side-discharging larry that moves at right angles to the bins and the furnaces. The charge materials are drawn one at a time from the respective bins into the charge car to the correct weights. The car then moves but a few feet to the furnace, where it discharges. These bins are used in connection with the Messiter system, which really makes up the ore charge before it is deposited in these ore bins. Many other examples might be cited of successful practice in mechanical weighing and charging.

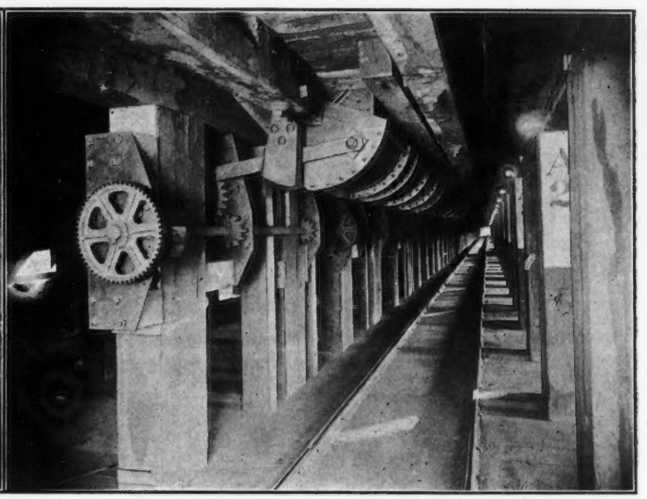
Until recently, however, the systems of charging in use at lead furnaces left much to be desired, nealy all methods involving much hand labor. Efforts were made to overcome this drawback, but with unsatisfactory results.

Lead Blast-Furnance Charging

The broad underlying principles of correct lead blast-furnace charging were most ably and clearly set forth by Arthur S. Dwight in his paper[1] before the American Institute of Mining Engineers. This paper deserves the title of a classic in metallurgy, for the entire profession is deeply indebted to Mr. Dwight for his exposition of the desirability of segregating the coarse into the center and the fine material to the sides of the blast furnace and for his invention of the "spreader" for accomplishing this. The adoption of the suggestion has materially improved the metallurgical recovery at many plants.



BELT FEEDERS UNDER HOPPER-BOTTOM BINS OPERATED BY GEARING FROM LARRY



ARC GATES UNDER FLAT-BOTTOM BINS ALSO OPERATED BY THE CHARGE-COLLECTING LARRY

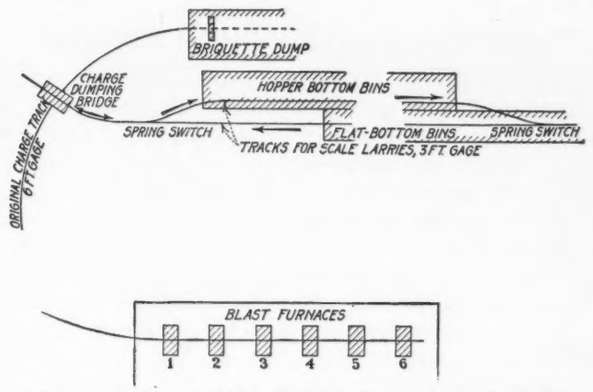
In this paper was described the Pueblo system of charging lead furnaces with the Williams charge car, the length of which approximated the length of the furnaces, thereby making it possible to drop a charge at one time throughout the entire length of the furnace. The charge car used at East Helena, Mont., was somewhat different in design, but still accomplished the same purpose of dropping the charge the entire length of the furnaces. In describing recent developments it is to be remembered that both cars, one or the other of which is to be found in the majority of mechanically fed lead plants in this country, required the services of a large crew of "charge wheelers" to obtain the various ingredients of the charges from the beds, bins, etc., wheel them to the scales, weigh them, wheel them to a slot in the floor under which ran the charge car and

[1]Trans., A. I. M. E., Vol. XXXII, 1902.

then carefully dump them so as to spread the materials evenly throughout the length of the car.

The work of these charge wheelers is exceedingly arduous. Much of the charge had to be shoveled up from the ground and only by most rigid watching could there be any certainty that the charges were being made up correctly. There was a strong temptation for tired men to slight the weighing and trimming of buggies, and not infrequently entire buggy loads would slip and become piled in heaps in the charge cars instead of being properly distributed. When a charge called for many ingredients and several blast furnaces started to run fast, it took an alert foreman to be certain that the small mob of excited shouting wheelers was getting the charges in correctly. If his attention was called away for a few minutes by trouble with bin gates or other distractions, only the carefulness of the "dumpers" could prevent mistakes. Realizing how dependent the plant operation was on this work, it was no infrequent thing for these charge wheelers to make sudden unreasonable demands and to go on strike, thereby tying up all operations. It will be realized therefore that although this system was a great advance over straight hand feeding, it still left much to be desired.

For some years no material advance seemed to be made over this system except in perfecting further Mr. Dwight's



TRACK LAYOUT FOR WHOLE CHARGING SYSTEM

spreader in the top of the furnace. It became recognized that too great a segregation of coarse and fine material in the furnace was as great an evil as no segregation at all. If possible the charge should have a uniform chemical composition throughout with a predominance of coarse material in the center. Too great a segregation tended to produce a condition wherein coarse limerock went to the center while fine leady material stayed on the sides with a tendency to start crusting. The segregating effect of the spreader was then modified, or "toned down," by making it of angle irons, leaving spaces through which some fine material could get to the center and prevent the charge column from becoming too loose and open.

A typical successful arrangement in connection with the Williams car is shown in an accompanying illustration. This spreader is lacking the center ridge of the Dwight spreader, but only because the charge is dumped in two streams from this car instead of one, as in the case of the Hixon car. Other plants using charge cars dumping in one central stream have purposely omitted the center of the original Dwight spreader so as to permit part of the charge to drop directly into the center of the furnace without segregation. Various other modifications are in use as the ores handled or the furnaces in service seem to call for them. Experimental work along this line is still going forward, but the soundness of Mr. Dwight's theories seems to remain unchallenged.

The International smelting plant at Tooele was probably the first to break away from the burden of the large crew of charge wheelers involved in connection with the charging system just described. To overcome this the charge bins were supplied with a series of weighing hoppers, one under each bin. Scalers weigh the respective ingredients into these hoppers. The charge car, having a hopper approximating the length of the furnaces, moves in a direction parallel to its length, traveling on tracks running from over the furnace tops to underneath the scale hoppers. It is apparent that this arrangement dispenses with charge wheelers. The scale hoppers are supplied with arc gates through which the weighed material is allowed to flow as the charge car runs back and forth underneath the respective hoppers in order to get the material distributed throughout the length of the car. No beds are made up, the greater part of the ore at this plant being sintered. The whole arrangement is well worked out and a great credit to its designers.

More recently there was installed at the Midvale, Utah, plant of the United States Smelting Co. still another system.[2] Here the Williams car with its small army of charge wheelers had been in use for several years. In designing the new system two things were aimed at, in addition to large economy in labor: (1) Getting the charges into the furnaces thoroughly mixed, and (2) getting uniform chemical composition throughout the length of the furnaces. The old system of layer feeding was justified in hand feeding whereby it was possible to get uniform distribution in the furnace. But any chemical reaction is expedited by intimate mixture of the ingredients involved. Furthermore the more uniformly the charge be distributed in the furnace the more uniform will be the furnace work. These theories seem to be borne out by a marked improvement in metallurgical results since the installation of this system, which closely approximates the ideal of steady, uniform feeding.

Charges Collected in Scale Cars at Midvale

In brief, the system at Midvale involves the use of scale cars and mechanical feeders. A row of hopper-bottom bins carries bulk material such as roast, limerock, iron ore, coke, etc. A parallel row of flat-bottom bins contains the beds.

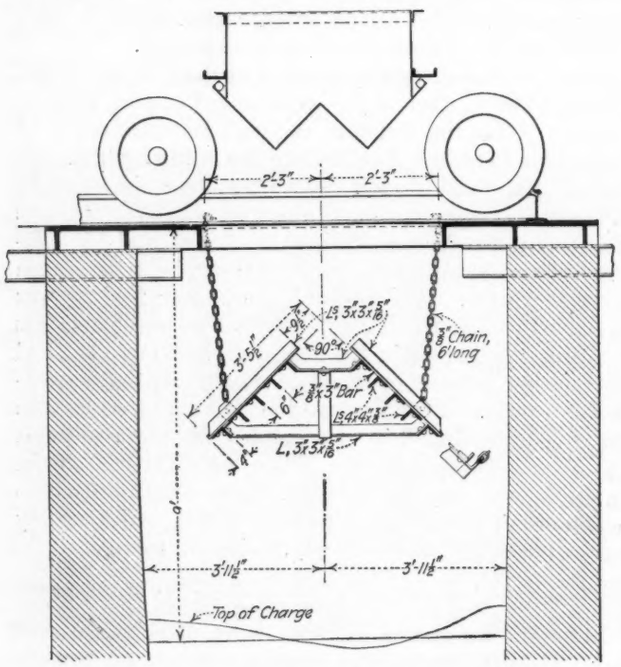
The scale cars carry hoppers mounted on scale beams, the length of the hoppers approximating that of the blast furnaces. Each car has mounted on it a 7½-hp. motor provided with mechanism by which it can be connected—by pressing a foot treadle—with any pair of feeders or arc gates opposite which the car may stop. There are eight scale beams, permitting as many ingredients to be weighed out readily. The feeders underneath the hopper-bottom bins are pairs of wide canvas belts; underneath the flat-bottom bins are pairs of reciprocating undercut arc gates. Bed ore is cut down by two men in the bed bins and shoveled to these arc gates, which are also operated by the 7½-hp. motor mentioned. This motor is handled by an Allen Bradley controller, giving sensitive control. To increase this sensitiveness and to avoid overweighing, the scale pointer is provided with a plus-and-

[2]U. S. Pat. 1,176,878 by Leslie Douglass Anderson, assigned to United States Smelting, Refining and Mining Co.

minus beam, which is set at the start of any weighing so the pointer moves when the total weight received is short, say 100 lb. of the final weight. Setting this auxiliary beam on the zero mark, the scaler then cautiously weighs in the remaining amount, having been forewarned and not, as usual, committing the error of overweighing.

The feeders and the arc gates are of extreme width, the purpose being to feed the hopper uniformly throughout its length. By this means the irregularity liable to occur when depending on hand distribution by buggies or by moving the charge car back and forth under a flowing stream is eliminated.

The original charge car at Midvale is still retained, existing construction making it impossible to run the scale cars directly over the furnaces as would have been desirable. Instead the scale cars now run on a bridge over the charge-car track. In this bridge is set a system of deflectors through which the charge is dropped, becoming thereby thoroughly mixed before it lands in the charge car



MODIFIED DWIGHT SPREADER AT MIDVALE, UTAH

beneath. After receiving this charge the car is backed a few feet under a floor with a slot through which briquettes and scrap iron are dumped after the old manner.

The track system for the scale cars is looped by means of two sets of spring switches which avoid any manual switching. Leaving the dumping bridge, the scale cars move under the hopper-bottom bins, stopping and drawing out charges at the designated points and proceeding ahead until the switch puts them over on the parallel track of the flat-bottom bins. Backing up on this track, one stop is made to draw out bed ore by motor, and finally the car is back at the dumping point again.

The scale cars are of heavy construction, riding on two swiveled four-wheeled trucks each having two large and two small wheels. The construction permits of passing around sharp curves. They were built by the Brown Hoisting Machinery Co., of Cleveland, Ohio, whose engineers deserve much credit for the manner in which they grasped the problem and fitted new construction to old.

The introduction of the system described made it possible to cut down the charge crew for five furnaces by over fifty men. The innovation, being somewhat radical in view of the well-known sensitiveness of the lead furnace, was installed with some apprehension which, however, has proved to be entirely unfounded. The greatest fear was felt lest the metallurgical recovery should be spoiled, or in other words, the loss of metal be increased. There has been found on the contrary a distinct improvement, which can be largely ascribed to the regular and uniform feeding that the furnaces have had since the installation of the system described.

Present practice indicates that whatever method of feeding be employed, the following principles must be carefully adhered to if the best possible results are to be obtained: The various charge ingredients must be correctly weighed. They must be disposed from one end of the furnace to the other so that a section at any point will show present the same proportions of the various ingredients as had been figured necessary for the entire charge. Mechanically all these ingredients should be well mixed together with a predominance of coarse in the center and fine on the sides. The simple statement of these principles is no indication of how far from simple it is to carry them out in practice at reasonable expense.

Rock Gas at Cripple Creek

The conditions attending the presence of rock gas in the Cripple Creek mines was investigated by George A. Burrell, at the suggestion of George S. Rice, chief mining engineer of the Bureau of Mines. An excerpt from the summary of a paper to be presented at the Arizona meeting of the American Institute of Mining Engineers in September, 1916, by George A. Burrell and Alfred W. Guager of Pittsburgh, Penn., follows:

The escape of gas from the rock strata into the lower workings of the mines of the Cripple Creek mining district is a menace to life and to mining. The outflow of this gas, supposed by Lindgren and Ransome of the United States Geological Survey to represent the last exhalations of the extinct Cripple Creek volcano, is largely influenced by outside atmospheric pressure, because it is confined in the rocks under low pressure.

At a few mines a pressure system of ventilation has been installed to assist the ordinary natural circulation. Under this system air is blown into the mines by a fan placed at the top of the shaft, thereby placing the mine workings under a little pressure, at some places equivalent to 6 or 7 in. of water (about 0.5 in. of mercury). This method assists materially in keeping the gas forced back in the rocks. The gas as it occurs in the rocks is a mixture of carbon dioxide (14%) and nitrogen (86%).

The bad effects on life and lights are principally due to the fact that the rock gas so dilutes the air of the mines that the oxygen therein falls to a point where lights will not burn or so low that life is endangered.

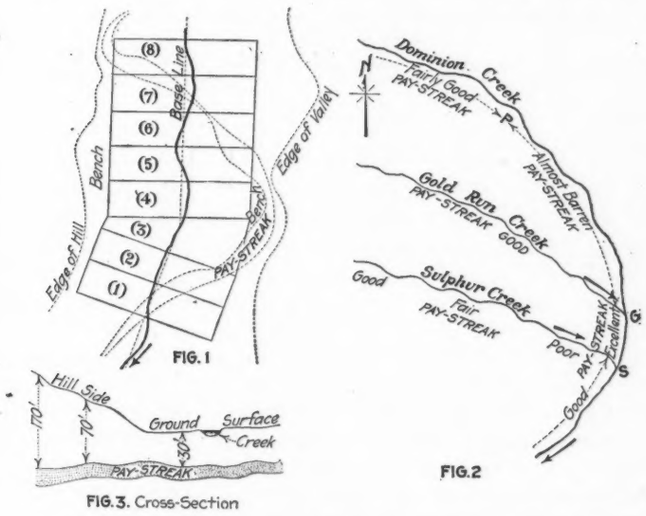
Men should not work where candles will not burn, and should not be solely reliant upon the acetylene flame for guidance regarding bad air. The acetylene flame will burn in air where the oxygen is only a few per cent. above the proportion that is dangerous to life, hence only a small margin of safety is assured. Because of the nitrogen content, greater danger is present in the lowest parts of the workings, particularly in the bottom of winzes and shafts.

Idiosyncrasies of the Paystreak

By J. A. Macdonald*

Visitors to the Yukon gold fields are often puzzled to account for the "idiosyncrasies" of the paystreak along many of the creeks. For instance, Fig. 1 illustrates a portion of Hunker Creek and the course of the paystreak. Across claims Nos. 1 and 2 the paystreak was satisfactory and proved profitable to the owners, and even where it crossed the corner of No. 3, it was so rich that No. 3 proved a valuable claim. But here it took a detour into the bench and left creek claim No. 4 completely barren, while the bench claims were found to contain more gold than claims 1 and 2. At claim 6 the paystreak narrowed to almost nothing, so that claims 6 and 7 were only moderately rich. After diagonally crossing No. 7, the paystreak widened out, increased in richness and thence went into the sidehill.

A wide paystreak is not necessarily the most valuable. The richest strike in the Yukon was on pay dirt 150



FIGS. 1 TO 3. SHOWING LOCATION, VALUE AND DEPTH OF DIFFERENT PAYSTREAKS

ft. wide; 300 ft. is not uncommon, and even 1,000 ft. widths are found at intervals. In some cases extremely narrow paystreaks have proved immensely valuable. On Lombard Creek the pay, which was all on bedrock from 6 in. to 2 ft. deep, was only from 15 to 25 ft. wide. About two years ago $12,000 was taken out of a claim near the mouth of the Lombard. The gold was coarse—a $10 nugget being the largest, while many smaller nuggets from $1 upward were found. A body of muck and ice about 30 ft. deep lies on top of the gravel. An effort is being made to open up some of these Lombard Creek claims.

Dominion Creek is famous for the amount of gold it has produced, chiefly from what is known as the upper and lower discoveries. It has its idiosyncrasies too. The upper discovery was certainly rich; farther down it was fairly good, but it petered out completely, and for 12 mi., including 120 claims staked out and persistently prospected, near the mouth of Gold Run, not an ounce of pay dirt was found. From point *G*, Fig. 2, the paystreak reappeared, and proved immensely rich. Here many claim owners made princely fortunes. Gold Run itself, for the first 4 mi. up from its mouth, showed a fine paystreak; Sulphur Creek, farther down, also had a very good one. At points *G* and *S*, Fig. 2, which are points of confluence of Gold and Sulphur Creeks, the valley of the Dominion is very wide, and the paystreak seemed to spread all over it. Below the mouth of Sulphur, the pay was not so rich, but was still considered good. Below was the mouth of Gold Run down some distance to below where Sulphur joins Dominion Creek, the valley widens out, and there the paystreak was approximately 1,000 ft. wide in many places. Along this stretch the pay gravel was quite rich. On claims 232 and 2,320, about $26,000 was taken out in six weeks. The pay channel on these two fractions ran directly across the creek almost at right angles—an unusual thing. Some miners claimed that this pay channel was part of the Dominion paystreak, and others that it came from the Veronica or Rob Roy, tributaries of the Dominion in the immediate vicinity. Shafts sunk on the Rob Roy Creek, with crosscuts driven from them for some distance failed to discover the pay.

The most acceptable theory is that this rich paystreak, beginning near the mouth of Gold Run, was a former continuation of Gold Run's narrow channel, which probably joined the old main channel of Dominion at some distance farther away than at present. The gold found in these fractional claims differs from that recovered in the claims on Gold Run. However, gold varies in grade not only from the different creeks, but also from different portions of a given individual creek.

The pay is frequently found in the sands at Nome, within two or three feet from the surface and is similarly found in some of the creeks of Alaska. For example, on Anvil Creek the pay was in some cases only 3 ft. from the surface. Ordinarily, however, the average depth of the paystreak is about 30 ft. On Bonanza Creek in the Canadian Yukon some of the best pay was found 27 ft. below the surface. In a cross-section at right angles to a given creek bed, both bedrock and pay gravel usually bed about horizontally, and seldom rise to parallel the surface slope. For example, illustrated in Fig. 3, near the creek the pay was found 30 ft. below the surface; further along, where the hillside rises, it was 70 ft., while in the hillside the pay was 170 ft. from the surface. With the downstream fall of a creek both bedrock and paystreak usually maintain their depth below the creek bed, sometimes for long distances.

*Box 83, Ottawa, Ont., Canada.

Franklin Mining Co.

The report of the Franklin Mining Co., operating at Demmon, Mich., for the year ended Dec. 31, 1915, shows an operating loss of $87,142. The company hoisted 151,269 tons of rock, of which but 122,018 tons was stamped. From this 1,314,969 lb. of copper was recovered, which sold at an average price of 19.83c. per lb.

The opening work put in sight, as of Dec. 31, 600,000 tons of conglomerate of average value. December production was 250,000 lb., and an amount equal to this figure has been sold for each month of 1916 at over 25c. per lb. No. 2 conglomerate shaft will probably be reopened this summer in the effort to increase production.

A Geologic Folio of Silver City, N. M., district has been published by the United States Geological Survey. The folio, No. 199, contains 19 pages of text, 2 maps, 1 structure-section sheet, 15 plates, 17 text figures, and is retailed by the Department at 25c. per copy.

The Control of Ore Slimes--II*

By Oliver C. Ralston†

SYNOPSIS—A continuation of the discussion of methods of controlling the actions of slimes. Experimental results are noted on selected ore slimes. It is shown that settlement can be accelerated or retarded, and that, under certain circumstances, a selective separation can be made, settling one constituent and allowing another to remain suspended.

The slimes upon which the major portion of this work was done were taken from the dump of the old Horn Silver mill at Frisco, Utah. This dump is finely ground material that contains quartz, feldspars, calcite, kaolin, sphalerite, galena, anglesite, cerrusite, pyrite, chalcopyrite and related minerals. A complete analysis of the ore is included in Table 1. The material has been ground several times by various parties in the attempt to extract the values contained. Most of it is already very finely ground, so the portion passing a standard Tyler 200-mesh sieve was screened out and weighed portions of this material were used in the tests.

Another ore upon which considerable work was done was the slimes from the Ophir Hill Consolidated mill, of Ophir, Utah. Small amounts of galena and sphalerite with some pyrite are carried in a quartzose gangue. Only the material passing a 200-mesh screen was used.

An oxidized ore from the Grand Central mine, of Eureka, Utah, was also ground through the 200-mesh sieve for test work. It is a thoroughly oxidized ore carrying copper, gold and silver. A great amount of oxidized iron minerals in the material gives it a bright-red color, although there is a considerable percentage of silica in the gangue. The fourth ore experimented upon was from the old Honerine mine, at Stockton, Utah, and was a thoroughly oxidized ore of zinc carrying smithsonite, calamine and limonite. It was also ground through the 200-mesh sieve.

Effect of Temperature on Settling

The increased rate of settling of ore slimes with increase of temperature has been known for some time, but so far as I know, no attempts to prove any explanations of these effects have been published. Richards[12] states that slimes will settle considerably faster in warm water than in cold water. H. S. Nichols[13] has conducted experiments on the settling of clay slimes obtained from a decomposed dike in British Columbia. His paper is very obscurely worded. He speaks, for example, of the "diffusion" of the pulp, where the context shows that he meant its "dilution." One series of experiments had to do with the effect of temperature on the rate of settling of pulps of different densities. He tested the rate of settling of one pulp at various temperatures from room-temperature up to 190° F. and then down to room-temperature again. He thought that possibly the settling velocity would be affected by air adhering to the particles, and if so, heating to nearly the boiling temperature of the water would remove this air, so that the series of settling curves obtained on lowering the temperature would be different from the series obtained in going up. No visible effect on the rate of settling was noticed. He found that at 60° F. a pulp settled at the same velocity no matter what the previous history of the solution.

As Durell[14] has recently speculated that poor settling in cyanide plants is often due to air in the solution, it might be well to call especial attention to the work of Nichols, which fails to confirm Durell's guess. I repeated Nichols' experiment, adding dry ore to water in order that air films might well be retained on the surfaces of the particles, and found the settling rates at 20° C., both before and after boiling out all air from the solution, to be almost identical. In fact, Nichols' slimes, on long boiling with simultaneous agitation, became deflocculated to the extent of not settling at all instead of settling faster.

TABLE 1. ANALYSES OF ORE SLIMES USED IN EXPERIMENTS

	Horn Silver	Ophir Hill Con.	Grand Central	Bullion Coalition
	%	%	%	%
Insol.	53.6	51.46	69.0	12.5
CaO	2.2	4.97	2.45	1.1
Fe	4.4	4.3	13.05	15.0
Al_2O_3	Undet.	Undet.	2.8	8.6
MgO	Trace	Undet.	Trace	8.7
Zn	6.3	3.9	0.58	29.9
Pb	7.4	3.83	0.05	0.21
Cu	0.25	1.16	1.04	0.13
S	6.13	4.69	Undet.	0.92
As	Undet.	0.25	Undet.	Undet.
CO_2	1.37	Undet.	2.60	19.04
	Oz.	Oz.	Oz.	Oz.
Ag	6.70	0.02	7.06	0.15
Au	4.12	Undet.	0.24	Trace

Nichols thought the temperature effect on the velocity of settling was due to the change in density of the water. Ashley[15] criticized this point and brought forward the idea that the different rates of settling were due to changes in the viscosity of the water. Caetani has reasoned that as the particles sink the water must rise through the tortuous channels between the particles and must hence overcome a frictional resistance proportional to the viscosity of the water and inversely proportional to the size of the channels. He calls attention to the fact that the viscosity of water at 80° C. is only one fifth of its viscosity at 0° C., while the density of the water changes only a small percentage in the same range of temperature.

In order to get definite measurement of the effect of temperature, I took settling curves on the Horn Silver ore, using pulp of 9.4% solids as a starting point in each case. Temperatures from 2° to 49° C. were investigated. The percentage of solids in the thickened pulp at different times is given in Fig. 1. These curves reveal an enormous effect of temperature on the rate of slimes

*By permission of the Director of the United States Bureau of Mines.

†Communicated by D. A. Lyon, metallurgist in charge of Salt Lake Station, in coöperation with the metallurgical research department of the University of Utah. O. C. Ralston, assistant metallurgist, Bureau of Mines.

This is the sixth of a series of articles treating of "Colloids in Ore Dressing." Former articles appeared in the "Journal" of Feb. 5, Mar. 4, Mar. 18, Apr. 15 and 29, 1916. The seventh will be a continuation of the discussion of this paper, and will appear in an early issue.

[12]Textbook on "Ore Dressing," Vol. II, p. 1147.

[13]"Min. and Sci. Press," Vol. XCVII, pp. 54-6 (1908). "Trans. I. M. M.," Vol. XVII, p. 293 (1908).

[14]"Liquid Jets," C. T. Durell, "Met. and Chem. Eng.," Vol. XIII, p. 714 (1915).

[15]"Min. and Sci. Press," Vol. XCVIII, p. 831 (1909).

settlement. Taking the time necessary to settle the material in a 200-c.c. graduate from 9.4% solids to 35% solids, as an example, it can be seen that it takes nearly four times as long at 2° C. as at 49°. Table 2 was prepared after this manner, giving the times necessary to allow the change in pulp density at the various temperatures, and a column of figures is included giving the absolute viscosities of water at these temperatures. The last column of figures in this table represents the quotients obtained by dividing the time in minutes by the absolute viscosity. For convenience these quotients are all multiplied by 10. In case the settling velocity is proportional to the viscosity of the water, these quotients should all have the same value. It can be seen that this is practically true with the exception of the one for 2° C. As these tests were made in glass graduates set in glass jars filled with water at the desired temperature and the

TABLE 2. EFFECT OF TEMPERATURE ON VELOCITY OF SETTLING

Temp. °C.	Time, Min.	Absolute Viscosity	Constant. (Time ÷ Viscosity)
49	14	0.0056	250
37	18	0.0070	257
22.25	24.5	0.0096	255
11.2	33.5	0.0131	256
2 (approx.)	54.5	0.0170	320

TABLE 2A. VALUES OF CONSTANT (TIME ÷ VISCOSITY) AT DIFFERENT PERCENTAGES OF SOLIDS

Temp. °C.	20%	25%	35%	40% Solids
49	116	152	250	456
37	121	164	257	430
22.25	129	161	255	396
11.2	131	174	256	389
2 (approx.)	159	212	320	440

temperature kept constant "by hand" by adding more hot water or ice, as occasion demanded, there was considerable difficulty in keeping the test at 2° C., and the value of the constant obtained at that temperature is known to be subject to considerable error. Table 2A contains the values of this constant obtained for the times when the various tubes were at the following series of pulp densities: 20%, 25%, 35% and 40% solids. The constants obtained when the pulps in the various tubes were at 35% solids are probably the least subject to accidental variations, as they had been settling long enough to minimize any accidental effect of turbulence that might affect measurements taken during the first few minutes of settling. The observations at 40% solids are on portions of the curve that are very flat, and the attainment of great accuracy of reading the position of the surface of the settling slimes was difficult, since the distances traveled were very small. So the observations at 35% solids may be regarded as being least affected by accidental variations or by errors of measurement. All of the readings at 2° are known to be of doubtful accuracy, but the values of the constants for this temperature are sufficiently near to the constants in the same column to reassure us. We may therefore conclude that the rate of settling of a slime is inversely proportional to the viscosity of the medium in which it is suspended.

Fig. 2 gives data derived from Fig. 1 and shows the actual velocity of subsidence of the surface of the thickening slimes as conditioned by the percentage of solids in the pulp at each of the various temperatures. In passing it is well to call attention to the fact that the percentage of solids in the pulp increases at practically a constant rate after the particles have attained their maximum velocities, starting from zero. This is shown by the straight portions of the curves of Fig. 1. The curve suddenly changes direction when the compacting phase of settling is entered and seems to be almost a straight line again. These observations hold for most of the curves prepared during this work, where percentage of solids was plotted against time. The velocity of settling of individual particles and of the surface of the slimes constantly decreases, but the rate of increase of the percentage of solids of the thickened pulp seemed to be practically constant, within limits, for most of the tests in the graduated cylinders.

Commenting on the curves of Fig. 2, it can be seen that the velocity of settling of the surface of the thickened slimes, as conditioned by the percentage of solids in the pulp, becomes very small at 39% solids. This low velocity is nearly the same for all the different temperatures investigated. At 39% solids is the point where the slimes enter the compacting phase in these experiments and slowly thicken to 50% solids. The slow rates of settling during this period did not allow measurements of sufficient accuracy to draw any conclusions as to the effect of temperature on the velocity of settling during the compacting phase, except that the velocity is rather small in any case and is probably conditioned more by the physical condition of the particles themselves than by the viscosity of the medium in which they are suspended. As all the velocity density curves converge to the point (39% solids) at which the pulp enters the compacting phase, it is possible to utilize a series of such curves for determining this critical point.

Effect of Heat Settling

An interesting experience was related to the writer by Walter Neal, who was at El Oro mill of El Oro Mining and Railway Co. during the winter of 1905. After an exceedingly cold spell the slimes of the mill suddenly ceased settling and nothing seemed to avail in making them go down. Finally, knowing that the solutions had been chilled much below their usual temperature, tests were tried with the pulp warmed slightly, and the slime was found to settle freely. A few steam jets into the solution soon put the mill in working order again.

It is hard to see how this strange effect could be due to temperature alone. A cyanide solution is truly a very complex solution after a few months' work, and it is probable that some effect on ionization of compounds in the solution may have allowed deflocculation of the slimes in question at the lower temperature. Further, in the phase-rule study of four component systems it is known that in any "reciprocal salt pair" only three of the possible four constituents generally exist at any one temperature, and there is a certain "transformation point" at which one of these three components disappears and above which the fourth component is formed. Such an effect, accompanied by adsorption of one of the vanishing constituents, might account for this phenomenon, but it would require the services of a skilled physical chemist to unravel this mystery. In fact, the possible complexities are such that it is doubtful whether such effects could ever be explained at all. For the present we shall have to confine ourselves to the elucidation of the simpler laws.

The relative rates of settling of slimes should be affected by temperature in the same way, no matter what the depth of the vessel in which the settling takes place. However, in order to gain some idea of the proper precautions to take in translating any results to the large scale, one test was run in a long tube which, in order to contain 200 c.c. of pulp, was four times as long as one of

the graduates containing 200 c.c. which were used in these tests. Of course it cannot be expected that the rate at which the average density of the thickened slimes increase will be as great in the long tube, for the reason that the individual particles have a much greater distance to sink through the water. It was thought, however, that the velocity of the individual particles might be the same in both tubes whenever, the percentage of solids was the same. In order to ascertain if this were the case, tests were made in a graduate and in a long tube with identical amounts of pulp (200 c.c.) of identical densities (9.4% solids at the beginning of 200-mesh Horn Silver slimes). In Fig. 3 are shown the settling curves expressed in the number of millimeters that the surface of the settled slimes had subsided below the surface of the clear water at any given time.

The slope of such a curve will be the velocity of settling of the slimes surface in millimeters per minute. From the reading of the graduate it is also possible to calculate the percentage of solids in the pulp, because the volume and weight of the ore are known and the volume of the pulp is read on the graduate. Determining the slope of the settling curve by a ruler laid tangent to it (this was the only method available in the absence of any method of deriving equations to fit the curves) and plotting this velocity against the average percentage of solids in the pulp at the time of measurement, we get the two curves given in Fig. 4—one for the long tube and the other for the graduate. They are surprisingly parallel to each other, and after settling has been under way long enough to eliminate accidental disturbances due to initial turbulence, the curves are almost identical up to the point at which the compacting phase sets in with the graduate. The humps and kinks of the two curves are closely parallel except that those of the long tube are magnified in comparison with those of the short tube. Owing to the fact that the long tube was settling a considerable time before compacting was reached, a considerable amount of compacting had taken place in the bottom before the pulp above it had finished the consolidation stage. The result was that a kink in the curve indicating the beginning of compacting was indicated at about 42% solids instead of 39% average solids. These conditions are much nearer to those of Free's tests, and with an even greater length of time necessary to reach this phase, as was necessary in most of his work, it is easy to see how this kink in his curve could be well smoothed out. The delay in the appearance of the kink for the compacting phase in the long tube makes it possible to understand the results of Mishler[16] at the Tigre mill, Sonora, Mexico, where it was found that thick slimes settled appreciably faster in tall vessels, while dilute slimes settled at about the same velocity in different-shaped vessels, depth having very little effect.

The strange humps and kinks in the two curves in Fig. 4, which are more exaggerated than with any other density of slimes studied, may be explained on the basis of our assumption of three possible types of settling—subsidence, consolidation and compacting. The long tube, which exaggerates the length of time during which each phase is followed, illustrates well the almost constant velocity exhibited while the particles are falling through the water individually. The transition to the consolidation phase takes place abruptly at about 19% solids, and after that the velocity of settling falls off rapidly for a a time. The transition to the compacting phase takes place with another sharp falling off in the settling velocity. The short tube exaggerates the second change.

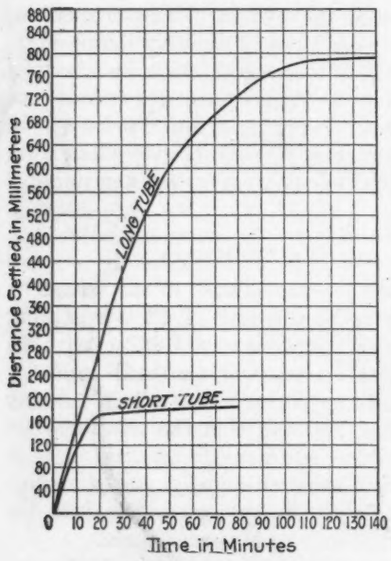


FIG. 3. SUBSIDENCE OF SURFACE SLIMES

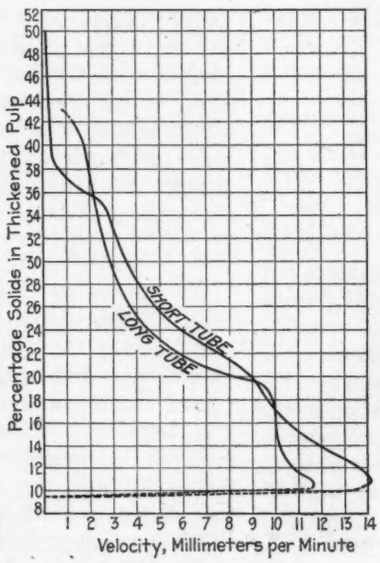


FIG. 4. SETTLING IN LONG AND SHORT TUBES

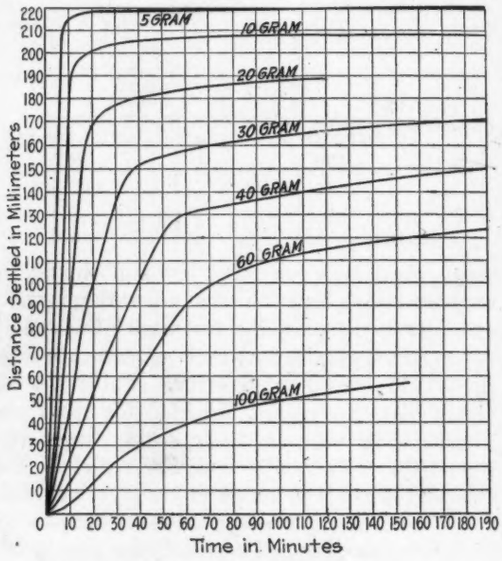


FIG. 5. SUBSIDENCE IN GIVEN TIME

The conclusion from all this is that the velocity of settling of the material in both the subsidence and consolidation phases is dependent largely on the percentage of solids in the pulp and not on the depth of the column of pulp (for equal volumes of pulp), while the velocity of settling in the compacting phase is greater the greater the depth of the column of pulp.

Tests were run in 200-c.c. graduates with different amounts of ore present in the 200 c.c. of pulp, so that there were different numbers of particles involved in each test; consequently for any given percentage of solids in a thickened pulp there were varying lengths of the columns of thickened slimes of the various tests. Contrary

[16] "Eng and Min. Journ.," Vol. XCIV, p. 643 (1912).

to expectations and seemingly contradictory to the conclusions of the tests reported on the long and the short tubes, the effect of thus varying the length of the column of pulp for any given percentage of solids in the pulp was to decrease the velocity of settling of the thickened slimes surface in proportion to the depth of the column of this material. One might expect the longer column of this material to settle the faster, just as a long column of rubber would compress more easily than a short one. Another warranted prediction could be based on the long- and short-tube experiment and would state that the velocity of settling would not be affected by the length of the column (within certain limits). Contrary to either expectation the long column of pulp containing, say, 20% solids settled more slowly than the short column of pulp containing 20% of solids. In Fig. 5 are the settling curves for lots of 5, 10, 20, 30, 40, 60 and 100 gm. of Horn Silver ore (minus 200-mesh), giving the distance that the surface of the thickened slimes had sunk below the surface of the clarified water at any given time. Fig. 6 was derived from Fig. 5 and shows the velocity at the time the average pulp density had reached any given percentage. One sees that at, say, 20% solids the pulp in the tube containing 40 gm. of solids is settling at a much slower rate than the one containing 5 gm. of solids. By taking the settling velocities of the pulp surface from all the curves at the points where the percentage of solids in each tube was 20%, the third column of Table 3 has been prepared. In the second column of the table is the depth of the column of settling pulp (obtained by subtracting the depth settled from the total depth of water in the tube). The fourth column gives the products obtained by multiplying each velocity by the corresponding depth, and it can be seen that the result is nearly a constant. Table 3A is a similar table for the same set of tests when each had reached an average of 30% solids.

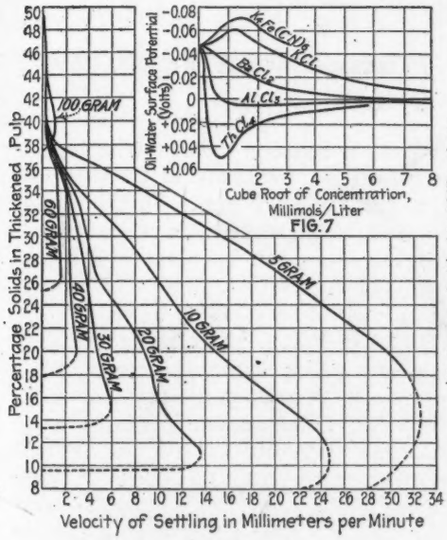


FIG. 6. VELOCITY AT GIVEN THICKNESS

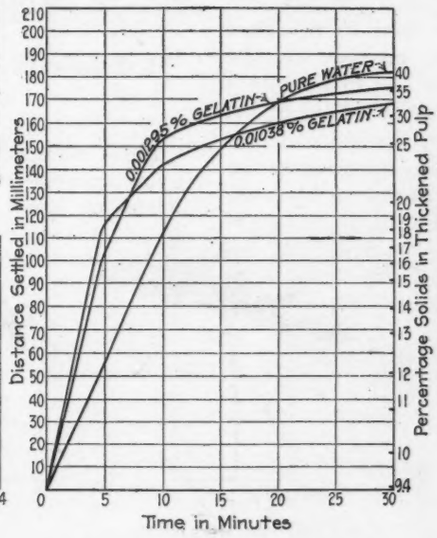


FIG. 8. FLOCCULATION WITH GELATIN

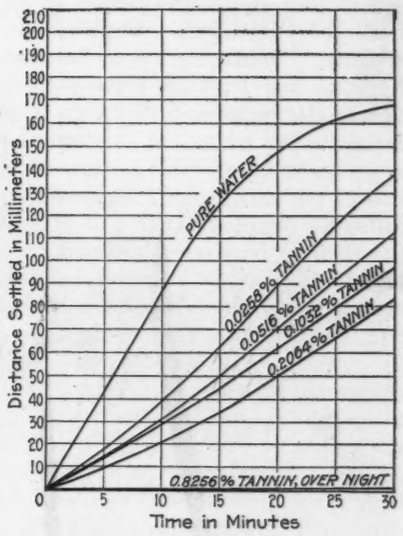


FIG. 9. EFFECT OF TANNIN

TABLE 3. AT 20% SOLIDS, IN 200-C.C. GRADUATES, HORN SILVER SLIMES

Wt. Ore, Gm.	Depth Pulp, MM.	Velocity, MM. ÷ Min.	D × V = k
5	28	30	840
10	50	15	750
20	98	8	784
30	135	4.8	648
40	184	3.0	552

TABLE 3A. AT 30% SOLIDS, IN 200-C.C. GRADUATES, HORN SILVER ORE

Wt. Ore, Gm.	Depth, MM.	Velocity, MM. ÷ Min.	D × V = k
5	16	16.0	256
10	30	6.8	204
20	59	4.2	248
30	83	3.1	251
40	112	2.4	269
60	188	1.5	282

Various electrolytes have been used in the control of slimes, and indeed it is the addition of electrolytes that is commonly implied when most people speak of adding various substances to suspensions in order to flocculate or deflocculate them. The use of lime in cyaniding to floc-

After the previous work with the long and short tubes, it was hard to accept this conclusion, but repetition and rechecking of the work failed to change the facts. In the long- and short-tube tests the same number of particles were arranged in tubes of varying length, the cross-section diminishing as the length increased. Why the long-tube tests do not compare with these is hard to understand, but it is also hard to see how cross-section can have any effect on velocity (when capillary tubes are neglected, as all of this work was done with tubes of over 1 cm. diameter). The only other variable that remains is the number of particles involved. Just how this could come about is not immediately evident, so that the facts are stated for what they are worth. It is possible that some kinetic effect such as that assumed in the "gas laws" and hinted at in the "brownian motion" of colloids (see any colloid textbook) can be called in to explain these effects, though there is doubtless some simpler mechanical explanation. Thus, twice as much water must escape from a long column of pulp, containing 20% solids, as from one only half as long. The size and number of channels is the same in both tubes, as they have the same cross-section, and hence it takes twice as long for this water to get out, with the result that the slimes in the longer tube settles only half as fast as that in the short tube.

culate the slimes and protect the solution of cyanide from decomposition by acids has become accepted practice. The use of sodium hydrate to deflocculate clays, in order to separate out the impurities by sedimentation, followed by flocculation of the suspended clay by alum or by sulphuric acid, is also well known.

One dilute slime that I studied at the Ontario mill, near Kellogg, Idaho, seemed to be completely deflocculated. It contained about one part of solids in 100 of water and was the dirty overflow of a Dorr thickener. Sodium chloride was added in increasing amounts until rapid settling took place. Nearly 1%NaCl was required in order to make a test tube of the suspension settle completely in 15 min. Sulphuric acid caused the same effect when present to the extent of 0.1%, and ferric sulphate caused a like effect when present to the extent of 0.01%.

The effect of electrolytes in the flocculation of colloids has been considerably studied by colloid chemists, and the following general laws are of interest here: The active agents that cause flocculation of colloids are the ions from the electrolytes. Positive ions tend to flocculate negative colloids and to deflocculate positive colloids. Negative ions have the reverse effects. As to whether a certain electrolyte will flocculate a definite colloid or not depends upon which ion is adsorbed by the colloid to the greatest extent, and this in turn depends upon concentration of the solution and temperature, as well as upon the colloid involved. The cause of adsorption is unknown. If the positive ions are adsorbed on a certain definite colloid more than the negative ions of the electrolyte, the colloid will be flocculated, and in case an excess of negative ions is adsorbed by the negative colloid, it will be deflocculated or[17] rendered more stable by the higher electric charges on the particles. Taking the case of a colloid that tends to adsorb different cations to a greater extent than the anions and comparing the effects of a series of electrolytes with different cations, it is noticed that a bivalent cation is many times as effective as a monovalent one and a trivalent cation is even more effective. Thus with a colloid suspension of quartz particles that are negatively charged, the amounts of electrolytes barely sufficient to produce coagulation are often found to have the following ratios for, say, the chlorides of sodium, calcium and aluminum, respectively:

NaCl	Valence of cation, 1	Coagulating power, 1
$CaCl_2$	Valence of cation, 2	Coagulating power, 40
$AlCl_3$	Valence of cation, 3	Coagulating power, 1,600

Why the polyvalent ions are more strongly adsorbed and hence much more effective as flocculating or coagulating agents is not known, but it can be seen that there are great possibilities in the use of polyvalent ions, such as those of iron, calcium, aluminum, ferrocyanides, ferricyanides, phosphates, etc., in the control of operations with slimes, such as settling or thickening, or flotation. The ratios given vary somewhat with different conditions and are so pronounced only in the case of suspensoids. Emulsoids do not react to the same extent. Emulsions of oil are met with in flotation, but not elsewhere in metallurgy.

The ions of hydrogen and hydroxyl, differing from other monovalent ions, are very strongly adsorbed and hence usually overshadow the effects of the ions that accompany them. Thus in acids the hydrogen ion usually exerts the most powerful effect, and in bases the hydroxyl ions are predominant. Hence, when acids are found to be flocculators, the bases are usually found to be deflocculators of the negative suspension—colloids. As most ore suspensoids are negatively charged, this particular effect of acids and alkalies is well known. Some of the weakly dissociated organic acids have special effects of their own.

The colloid chemists have worked with a great many different suspensions, and the polarity of the charges on some of these is given here. Most of them are compounds prepared in the laboratory and were suspended in distilled water. Among the positive sols may be mentioned ferric hydrate, aluminum hydrate, chromium hydrate, cadmium hydrate, most other hydrates, titanic acid, methyl violet, methylene blue, magdala red, some metals like lead, bismuth and iron, etc.[18] The negative sols include most metals—for example, gold, platinum, cadmium—and many metallic compounds like silver chloride, arsenious sulphide, cadmium sulphide, prussian blue, colloidal sulphur, silicic acid, stannic acid, vanadium pentoxide, molybdenum blue, indigo, etc.

[17] W. W. Taylor, text on "The Chemistry of Colloids," p. 107.

[18] Taylor, ibid.

Russian Manganese Industry

By M. Stromberg*

Russia takes the first place among the countries supplying manganese ore, which represents one of the principal articles of export to the United States. In the decade 1903-12 (the last period during which data on the world's production of manganese ore can be obtained) Russia supplied 37% of the total production, British India supplied 20%, and Brazil yielded about 12%.

The principal district in Russia where manganeses ore is mined is the Caucasus, which during the decade 1904-13 yielded on an average 33,250,000 poods (600,378 tons) per annum, or about 75% of the annual Russian production. The annual production of the Nikopol district, second in importance, averaged 10,800,000 poods (195,010 tons), over 24% of the total production. In the other districts, the Ural and Western Siberia, the output did not reach any considerable magnitude in 1912; the Ural yielded 1,900,000 poods (21,487 tons) of manganese ore, while the production in Western Siberia did not exceed 8,400 poods (152 tons).

Recently attention has been drawn to a new region producing manganese ore—the Gaisinsk district in the province of Podolia near Hoshevatovo, on the Rudnitza-Olviopolsk line of the Southern Side railways. The natural supply of the ore, a pyrolusite, is apparently a large one; the distance from Odessa by rail via Rudnitza is 334 versts (221 mi.). Up to the present the mining is in an embryonic stage, and according to private information, the production has not exceeded 25,000 poods (450 tons), which has been supplied to the southern metallurgical works.

The manganese industry of the Caucasus, concentrated in the Shoropansk district of the province of Kutais, near Chiaturi, works chiefly for the export trade. During the decade 1904-13 the annual exports of Caucasian manganese ore averaged 37,700,000 poods (680,730 tons), distributed as follows: 640,825 tons (93.97%) was exported to foreign countries, while 39,900 tons was supplied to South Russia.

*Editor "Journal of the Russian-American Chamber of Commerce," 27 Gr. Jakimanka St., Moscow, Russia.

The Oatman District, Arizona

By Leroy A. Palmer*

SYNOPSIS—A description of the mines and development of this new low-grade gold camp in Arizona, which it is believed will develop several steadily producing mines. A well-equipped town of several thousand inhabitants has resulted from these unusual and interesting developments.

The Oatman district is situated in Mohave County, Arizona, about 12 mi. east of the point where California, Nevada and Arizona come together. It is reached by stage from Kingman, Ariz., 27 mi., or Needles, Calif., 20 mi. distant. The early history and geology of the region were described by J. D. Speer in the *Journal* of Jan. 1, 1916, and so will be omitted here except to state that low-grade free-milling gold is found in shoots in fissure veins under a capping 300 to 400 ft. thick. The real revival of the district occurred in the spring of 1915. The Tom Reed mine sunk a new shaft, crosscut and missed the vein. Two practical miners, George W. Long and T. L. McIver, formed a theory regarding the location of the vein, substantiated their theory by underground observations at the Tom Reed, and bought what they felt were the proper claims on which to find the vein. They were able to raise sufficient funds for the necessary development work, which revealed a vein of good ore 30 ft. wide at the 300-ft. level. This is the nucleus of the present United Eastern, which was placed on a firm basis by the backing of such men as D. C. Jackling, Philip Wiseman, Seeley W. Mudd and Frank Keith and others.

Broadly speaking, the veins of the district might be divided into four zones from north to south as follows: The Gold Road, Tom Reed, Vivian and Black Range. These exhibit distinct fissure systems, but appear to converge toward the southeast. Another zone might be distinguished toward the northwest in the vicinity of the Times, Hercules and Pittsburg. The veins in this locality have nearly east-west strikes, but it is probable that they properly belong to the other zones and have locally been deflected from their normal courses. The Gold Road and Tom Reed zones have been traced northwesterly for several miles, as far as Union and Secret Passes.

The low grade of the veins, many of which are concealed by detritus or flows, and the lack of bonanza ore have demonstrated the necessity of deep work and the development of sufficient backs to guarantee continuous milling operations before any attempt at output can be made. Because of the comparatively gentle topography, the hills not rising to any great heights above the surrounding country, there are few instances in which tunnels can be used. The customary procedure is to sink in proximity to the vein and crosscut at from 300 to 500 ft. depth. The andesite is not hard, breaks well and stands without heavy timbering, 8-in. sawed timbers being used in most of the shafts. Naturally timbers are expensive but with good superintendence a two-compartment and manway shaft can be sunk and timbered for $30 to $40 a foot.

THE CAMPS OF OATMAN AND OLD TRAILS, ARIZONA, AND THE SURROUNDING DISTRICT

*Mining engineer, 512 Custom House, San Francisco, Calif.

The first indications of the vein are small stringers of quartz and calcite scattered through the andesite and exuding water. At about the time these veinlets appear, the andesite walls show slight pyritization and will yield a little free gold in the pan. In the oreshoots the vein matter shows pronounced hematite and manganese stains.

Many of the veins show considerable width. The United Eastern averages 25 ft. across; the Big Jim was cut at an angle giving a width of 46 ft. and is estimated to have a width of 40 ft. The United Western went 15 ft. through the vein to a horse, and had just cut through the horse when water was encountered in such quantity as to make a temporary cessation of work necessary, so the width of the vein is not known. The oreshoots usually carry gold for the full width of the vein and may be anywhere from 50 to 350 ft. in length with about the same amount of barren ground.

Water is invariably encountered in the veins at depth, and although the flow is small, the handling of it has been the cause of some embarrassment. The supply of commercial electric power is limited, and consequently the rate is high. For this reason most of the mines have installed gasoline plants, which are obviously unsuited to underground pumping operations. At least one mine has installed a steam pump, but fuel is high and steam is always a disadvantage underground.

All the developing mines are equipped with gasoline power. Almost without exception the plants appear well-chosen and well-installed, and amply but not over equipped. Hoisting is entirely by buckets, which in many instances are equipped with the platform crosshead for the use of the men.

In the two producing mines three systems of stoping are in use. Some of the Tom Reed stopes are square-set, while the Gold Road is using the shrinkage system where possible, but has resorted to filling in some of its stopes, the condition of whose walls does not suit them to shrinkage. In general the andesite walls of the district, although brecciated to some extent, stand well, and this, in connection with the wide veins, some averaging 30 ft. for considerable distances, offers an ideal condition for shrinkage stoping methods to be used.

Continuous Counter-Current Decantation Used

There seems to be no choice in the matter of milling practice. The gold is all free, but so fine that efforts to recover it by amalgamation have been wholly unsatisfactory, a saving of only 35% on the plates being realized in the early mills. The ore is, however, readily amenable to cyanidation at a reasonable cost and an extraction of 90% or better is obtained.

It is probable that the Colorado River, 2,000 ft. lower than Oatman, has established a permanent water level for this country. If such proves to be the case, the oxidized ores may reasonably be expected to extend to that depth, so that present milling practice will be standard for years to come with the exception of minor changes such as at present exemplified by the United Eastern, which will use ball mills for primary crushing instead of stamps, the old regulation standby.

While the Gold Road mill has been described heretofore, a brief outline of the practice at this plant will be given as exemplifying the milling system that will undoubtedly be generally adopted for the treatment of these ores. The ore is hauled about 1,000 ft. from the crusher bins at the shaft in mule-drawn trains and dumped to the battery bins. From these it is fed by swinging feeders actuated by a stamp tappet to eight 5-stamp batteries of 1,050-lb. stamps, where it is crushed in solution. The pulp from the batteries goes to five duplex Dorr classifiers, the sands from which go to four 4x22-ft. tube mills using Danish pebbles. From this point on the process is a continuous counter-current decantation using Dorr thickeners and Pachuca tanks.

Instead of using filter presses for the separation of the tailings, the solution is displaced in the last series of tanks by water from the mine and the tailings discharged continuously from the bottoms of the tanks. The pregnant solution is clarified, mixed with zinc dust and passed through a Merrill press. The precipitate is roasted and run down in a tilting furnace. Extraction by this process is 92% with a consumption of one pound of zinc and six-tenths of a pound of cyanide per ton of ore treated. Costs are from $2.50 to $2.75 per ton, but it should be borne in mind that present costs of any chemical treatment can hardly be taken as a fair criterion. The mill is treating 260 tons per day.

Typical Mines of the Various Zones

Obviously even a brief description of all of the operating properties in the district would be out of the question. Very brief mention will be made of one or more of the mines on the different zones, but it should not be assumed that the property chosen is necessarily any more representative than some other might be.

The most important mine on the Gold Road zone is the mine of that name. The geologic formation at Gold Road is the same as that throughout the district, but with the peculiarity that here veins are found in the rhyolite dikes as well as in the andesite. The mine is opened by two shafts, No. 1 and No. 3, which are 800 and 1,100 ft. deep respectively, the 1,100 level at No. 3 being equal to the 900 level at No. 1. The main workings are on the 700 level of the No. 1 shaft. The vein is from 8 to 10 ft. thick and is mined by shrinkage stoping and filling. In the earlier days of the mine an open stope was carried from the 800 level clear to the surface.

The ore is hoisted at the No. 1 shaft by a 15-hp. variable-speed electric hoist with double drum, operating one automatic dump skip and a counterbalance. It is dumped to a bin from which it goes over a grizzly to a 5K Gates gyratory crusher and thence through a raise to a bin gate in a tunnel 50 ft. below. The tunnel is on a level with the bin track at the mill, and transportation is effected by mule-drawn trains.

A central power plant with 200-kw. motor drives a 15x25x20 Ingersoll-Rand two-stage compressor and a dynamo for the lighting system. The compressor supplies air at 100 lb. to both shafts and the mill.

Gold Road is producing approximately $700,000 per annum. It is paying dividends, but the amount is not given out, all of the stock being owned by the United States Smelting Co.

Just at present the Gold Ore mine, joining the Gold Road on the north, is attracting considerable attention from the fact that it has become a producer on a small scale. The company, operating to the 550-ft. level, has opened some rich shoots in a 6-ft. vein, but is taking out only its low-grade ore and sending it to the Gold Road mill, mainly to dispose of ore taken out in development

and to determine if Gold Road milling practice is suitable to its ore.

A new property, on which the only development is a 50-ft. shaft sunk by hand, is the Midas. It is on the Gold Road zone some distance beyond the Moss and is of interest in proving the continuity of the vein system. In its present stage of development nothing can be said of the Midas further than that surface conditions are as favorable as those usually found in the district.

The Tom Reed is operating from one main shaft which is 900 ft. deep with about 4,000 ft. of drifts. Milling practice is similar to that at the Gold Road, but the mill is smaller, having a capacity of 125 tons a day. Dividends to date are in excess of $2,500,000.

It was the loss of the main Tom Reed vein that led Long and McIver to start the work that resulted in making a mine of the United Eastern. The old shaft has been carried down 700 ft. with levels at 307, 463, 565 and 665 ft. All these levels have found ore and about 2,000 ft. of drifting has been done. Various statements have been made as to the value of the ore blocked out. Inasmuch as the most conservative, $10,000,000, comes from the management, it is safe to regard these figures as authoritative. The average value is from $24 to $25 a ton; all samples running over $100 a ton being disregarded.

The shaft is equipped with a 30-hp. gasoline hoist and a 12x7½-in. straight-line compressor. A new two-compartment shaft is being sunk about 1,000 ft. from the old one, and the machinery has just been installed. This consists of a double-drum hoist geared to a 150-hp. variable-speed induction motor and a 150-hp. motor belted to a 12x19x16-in. two-stage Ingersoll-Rand compressor.

Grading for a mill is in progress near the shaft. It will follow the general practice of the district, but will use ball mills for primary crushing instead of stamps.

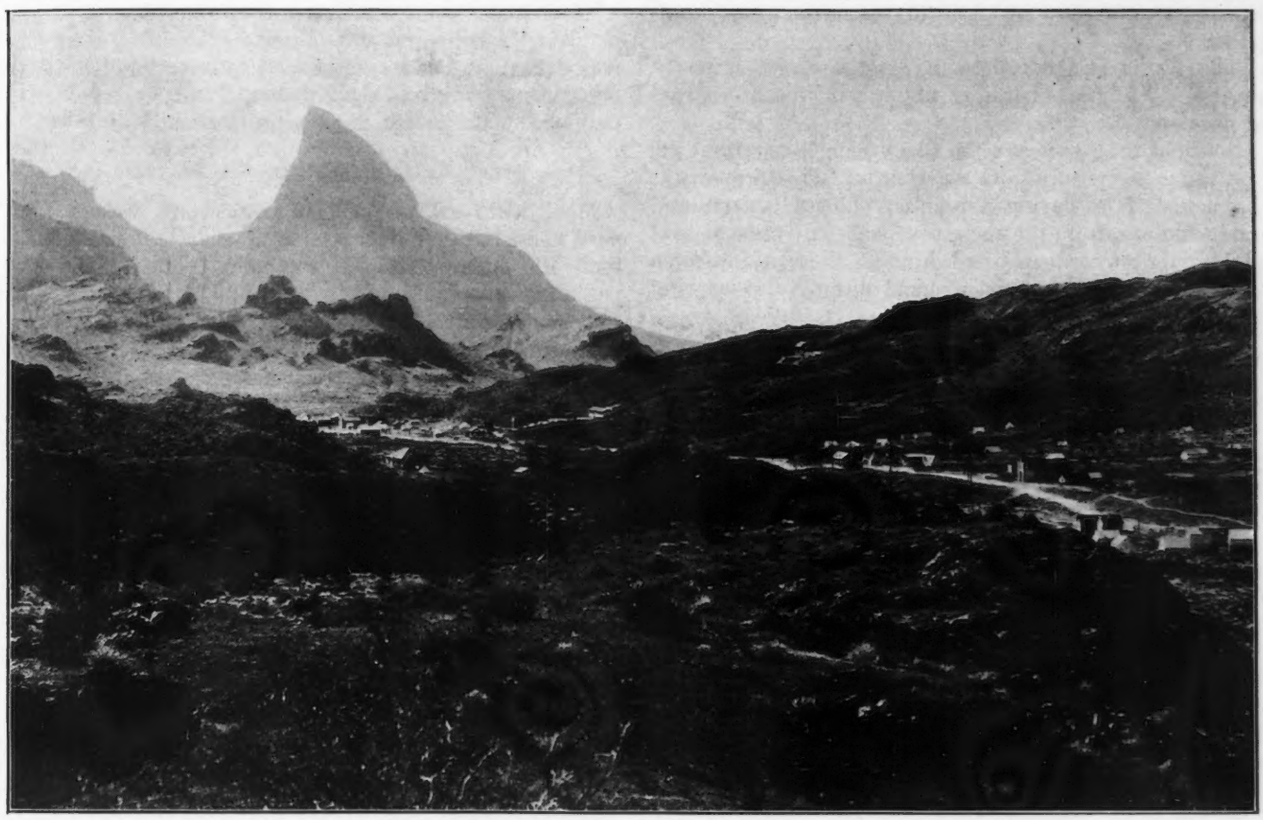
Of the new mines, next to United Eastern, Big Jim is probably the most developed. This mine has crosscut a 40-ft. vein on the 400 level and, at the time these notes were made, was expecting to reach the vein on the 500 any day. The average of the vein from wall to wall is $7.44, but it is expected that the average of the ore handled will be increased by careful mining.

Big Jim is one of the best financed companies in the camp and, now that ore seems to be assured, is preparing to equip with larger compressors and 150-hp. electric hoist, steel gallows frame and mill.

Another mine on the Tom Reed zone is the Oatman Gold on a vein system paralleling the main Tom Reed vein and extending northwesterly through the Fessenden. The Oatman Gold has sunk to the 500 level and extended a 15-ft. sump on its Kokomo vein, which appears for 4,500 ft. within its lines. At the Kokomo shaft two small feeders intersect the main vein, and these feeders show rich ore. The shaft is equipped with a 20-hp. gasoline hoist and a 14x8¾-in. 300-cu.ft. compressor.

As previously mentioned, the United Western has cut a 15-ft. vein, but has been delayed from proving it on account of water. The 15 ft. gave assays running from $8 to $16. This vein outcrops noticeably on the surface and at a depth of 65 ft. ran $2.50 to $3 a ton. It is equipped with a 50-hp. hoist and a 14x15-in. three-drill compressor belted to a 60-hp. gasoline engine.

The Tom Reed zone is the most developed and the one on which the most interesting discoveries have been made.



THE CAMP OF OLD TRAILS, WITH BOUNDARY CONE PEAK IN THE DISTANCE

The Vivian zone is so-called from the Vivian mine, which, in times past, had a production estimated at $100,000, but which has been idle for several years. In this zone are the Gilt Edge, Boundary Cone, Dome and several others. These properties are in the prospecting stage.

The principal mines of the Black Range, the most southerly zone of the district, are on a very prominent quartz outcrop, locally called the Nellie vein, which can be traced across the country through the Black Range and Nellie groups for several thousand feet and which, having resisted erosion more than the inclosing andesite, stands up boldly to a height of 25 ft. or more.

The Black Range has sunk a shaft to a depth of 300 ft., which cut the vein at 150 ft. At the 300 a crosscut was started and run 120 ft., when it was found necessary to stop work until equipment could be installed for handling the water. The equipment consists of a 60-hp. gasoline hoist and two straight-line gas-driven air compressors.

The Nellie and the Oatman Syndicate, the latter in control of J. Parke Channing, are still in the early stages of development.

South of the Nellie and the Black Range operations are just commencing on the Green Quartz. This property is distinguished by having a peculiar chloritic quartz and producing ore, from the surface, of sufficient value so that the former owner supported himself thereon for some years by the crude method of hand mining and working his ore in an arrastre.

What is sometimes called the Northwest zone embraces the Times, Pittsburg, Hercules and a number of neighboring properties, in which the veins have a general easterly and westerly strike and a northerly dip. It is probable that development will demonstrate that these veins are continuations or offshoots of the main fissures which, locally, have taken a different course.

The Times, considering the stage of its development, is one of the best-equipped mines in the district. A 22-ft. vein, supposedly a continuation of the Tom Reed, was found on the surface, and assays from a general sample taken out while excavating for the hoist returned $27 a ton. A shaft has been sunk 150 ft., and cross-cuts are being driven to the vein, and at another point it has been reached by a 300-ft. tunnel. Equipment consists of a 25-hp. gasoline hoist and a 14x8¾x10-in. angle compound compressor belted to an 80-hp. engine.

Boom Based on Quantity Means Stability

While it is no doubt proper to designate Oatman as a boom camp, it is different from other boom camps of recent years. Strikes have been sensational from the standpoint of quantity rather than quality, and from the start it has been recognized as no poor man's camp. This has brought home the fact that while the district has great possibilities, it is going to take money to realize them. Everywhere there is a spirit of optimism and enthusiasm, but the hysteria that accompanies the possibility of getting rich over night is lacking.

All transportation of passengers is by automobiles, and motor trucks are used for all the freight except that destined to be hauled over the steepest roads, in which case string teams of ten, twelve or even more horses or mules are used. Freight rates are rather high—$12 to $15 a ton from Needles or Kingman—but the necessities of life are very reasonable in comparison with other districts similarly situated. With the exception of certain commodities, particularly hard to get, such, for instance, as fresh milk, it is probably a fair estimate to say that ordinary living expenses are not more than 20 to 25% higher than in the Coast cities. Rooms can be had for a dollar a day and upward, and a good meal can be bought for from 50 to 75c.

A stock exchange has been formed recently with a membership of 47, of whom it is expected that 15 to 18 will engage in active trading. The first session was held Apr. 10 and 28,100 shares were sold at an average price of 38c. per share. This move has been looked at askance by many who have seen the baneful effects of stock manipulation in some of the Nevada camps. It is hardly likely, however, that it will have a serious effect on legitimate operations in Oatman. For one thing the fact that the actual value of the mines will depend on systematic development work and conservative management rather than a chance lucky strike will limit speculation in the stock. Another reason is that Arizona has and enforces a rigid blue-sky law. A repetition of the Sullivan Trust Co. or Nat C. Goodwin & Co. is not possible in Arizona.

Arizona Laws Check Wildcatting

Many will recall the incident of a certain Nevada "copper" whose treasury stock sold up to about a dollar a share under the manipulation of a famous operator, only 20c. per share of which found its way into the treasury. This could not occur in Arizona, as the law specifies that a certain percentage (85, I believe) of the money derived from the sale of treasury stock must actually be paid into the treasury. Further, it is provided that promotion stock must be pooled and not thrown on the market until the company is properly financed, so that the money paid for stock in the financing stages of a mining venture actually goes to the development of the mine and not to enrich some promoter.

Operating under these restrictions there has been more money actually paid into the treasuries of the various mines than in any other camp of recent years at the same period in its history. It is also true that development and operation have been on a more systematic scale and under more practical mining men than has been the general rule.

As a matter of uniformity the managers recently got together and adopted the following scale of wages, which was accepted by the miners. There is a union in the camp, but membership is not compulsory and the district is open. Following is the scale that went into effect Apr. 16:

Hand miners	$4.00
Hand miners in shaft	4.50
Machine miners	4.50
Machine miners in shaft	5.00
Timbermen	4.50
Muckers, trammers, nippers and topmen	4.00
Millmen	$4.00–4.50
Minimum for unclassified labor	$3.50

Power for operating is one of the problems of the district. There is no hydro-electric power available and only one commercial power company—the Desert Light and Power Co., of Kingman. Consequently most of the companies have installed their own gasoline plants. Power from either source costs about $15 a horsepower-month.

Costs of mining and milling should be fairly uniform throughout the district. Total costs at the Tom Reed are in excess of $8 a ton, but it is the general opinion that this is too high. One engineer has submitted tentative

costs on cyaniding at a maximum of $2.30 per ton under normal conditions and it is generally considered that on a basis of moderate production total costs should not exceed $5 a ton.

A Well-Equipped and Substantial Town

Oatman has gathered its population from all the mining districts of the West. The man who went over the Skagway trail in '97 rubs elbows with the old timer from Gilpin County or the man who shipped the bonanza car from the Hayes Monette lease, all brought there by the same attraction.

The influx has been greater than there were permanent accommodations for, and the whole district is dotted with tents and small shacks. But for so young a town Oatman is unusually well equipped to supply the necessities and comforts of life. There are churches and schools and, except the saloon, every conceivable business, even to a hairdresser and manicure. There are several large stores carrying good stocks; business is good and collections prompt. There are three banks, one strictly local and two branches of larger institutions at Phœnix and Kingman. Oatman has electric lights, Postal and Western Union telegraph, local and long-distance telephone service, three hotels, numerous rooming houses, two weekly newspapers, two first-class picture shows, several restaurants, one with an orchestra, dance floor and near-cabaret, a roof garden and men's social club.

The residents have been too busy to get together and incorporate a city, but the business and social welfare is overseen by the Oatman District Chamber of Commerce, which has 150 members and a very much on-the-job secretary. Through its efforts the town has been equipped by means of private subscription with a water system with fire plugs and a volunteer fire department with hose cart and chemical engine. The locality is naturally healthy, and to keep it so, the Chamber of Commerce has distributed garbage cans and disinfectants to the residents, calling their attention to a state law enjoining the use of such preventatives of disease.

As soon as Oatman realized it was shooting out of its knickerbockers, it took steps to make a city of itself. Jan. 1 Main St. was a wagon trail in a gully with buildings every which way. Now it is a four-rod surfaced street with the buildings bearing at least a semblance of alignment. There are several three-story buildings, and some of the office buildings have a neat stucco finish.

The town is supplied with good water from springs, which is pumped to large tanks at an elevation sufficient to give ample pressure for fire protection. The supply is sufficient for a town of 8,000, and other sources are available from which the total supply obtained would answer for twice that number.

A Boozeless Boom

Oatman is dry and glad of it. Notwithstanding a recent Supreme Court decision holding that one could bring liquor into the state provided he did not sell it, Arizona has started out to prove that prohibition can be made to prohibit. Needles, Calif., is only 20 mi. distant, with liquor galore, but in four days in a real live mining camp I saw only two cases of intoxication, both slight, and I know that one of them came from Needles.

There are two police officers in camp, a deputy sheriff and a night watchman. The deputy has about the easiest job of anyone in the district, his most strenuous duties being to keep the traffic moving, and the night watchman was engaged only Apr. 1 as a precaution against fires.

I learned of only one case of claim jumping, which was settled amicably. There have been only two public fights in the last four months and not a shooting scrape since the newcomers came in. One of the most peaceable men in the place has been known as a notorious gunman through many of the boom camps of recent years. Not feeling properly dressed without his favorite Colts and learning that he could not pack them without a permit, he applied to the sheriff only to be told that there was strictly nothing doing. So, like all of the rest, he goes about his business without his "irons" and finds that he has no use for them in this model community.

An attempt has been made to inject a touch of high life into the district at the "49 Camp," about half a mile from Oatman proper. Here there is a dance hall with the usual appurtenances, but it is a pretty tame affair and the strongest you can buy your lady is "Tally—Guaranteed no alcohol." If there is a game of stud, a faro layout or a roulette wheel in the camp, only the initiated know the trail and they are not telling it. The streets are alive in the early evening, but about the time the movie show lets out the lights are dimmed and there is a general movement toward bed, to be ready for another day.

All these restrictions have a very important bearing on the great industrial problem. This was sized up very tersely by one of the older residents of the camp. The conversation had turned toward the possibility of labor trouble, when he said: "Well, you know a miner is a natural-born spender. He has to spend his money for something. Up here he can't put it into booze or over the table so he is investing in stocks in these mines, and these fellows aren't going to be in a hurry to start anything that will hit their own pocketbooks unless they have a real grievance."

I learned by inquiry that this statement is true and that an unusually large number of the men, especially the older residents of the camp, have invested in local stocks. Sentiment as to prohibition is unanimous. Miners, operators and business men declare that business is better than with liquor and gambling and that their absence is directly responsible for the orderly condition of the district

Will Be a Large Low-Grade Camp

The "expert" has been fooled so many times that the engineer who has the temerity to predict the future of a new camp is generally regarded by his colleagues as rushing in where angels fear to tread. However, developments at Oatman are now sufficiently well advanced to allow of some prediction of the possibilities of the district. The Gold Road and Tom Reed are proven mines. The United Eastern, with its $10,000,000 of probable ore, can certainly be called a mine. The Big Jim will soon have done sufficient work to entitle it to this dignity. Possibly United Western will soon be in that class also, as well as some of the others.

The veins are traced for great distances along the surface, they are wide and are unquestionably true fissures. The natural conclusion is that they have depth. Whether the ore persists, to depth, development alone can demonstrate, but even if they do not extend beyond the proven limits of the Gold Road and Tom Reed, there will be ore in the district for a generation to come.

It must not be assumed that all the mines now developing are to become dividend payers or even producers. Inevitably, some of them, especially the later ones, which took the ground left between the pronounced mineral zones, will draw blanks. But I believe that from the production standpoint the Oatman district will be comparable with the Tintic district of Utah. Tintic has produced steadily for the past 45 years. The ore is in shoots, and from time to time a mine lacking development drops out, but there is always a steady output from a large number of mines and a goodly portion of them are paying dividends.

As yet the geology of the district is little understood, and it may be that future developments will reveal possibilities not now recognized. The orebodies of Goldfield were twice delimited before Jumbo Extension drove into the shale-latite contact and made a bigger mine of itself than it had ever been before.

It is hardly to be expected that Oatman will produce another "Big Bonanza" or another Homestake, but I believe that the conservative attitude of the people and the investors, the employment of practical mining men to handle the mines and the money available for development work give reason to believe that it will eventually become a large low-grade gold camp with several productive properties of moderate size which can be depended on for production and dividends for some years to come.

Utah Copper Quarterly Report

The report of the Utah Copper Co. for the first quarter of 1916 shows a production of 36,564,533 lb. of copper—11,999,910 lb. in January, 11,849,972 lb. in February and 12,714,651 lb. in March. The total ore treated was 1,984,600 tons of average grade of 1.4333% copper. Average extraction was 64.27%.

After making allowances for smelter deductions and crediting miscellaneous income, including Bingham & Garfield Ry. earnings, the average cost of copper was 7.19c. per lb. Total net profit was $7,079,830; dividends paid, $4,061,225; and net surplus, $3,018,605. Earnings are computed on a basis of 26.131c. per lb. for copper. Dividend paid on Mar. 31 was at the rate of $6 per year, plus an extra dividend of $1 per share.

Ray Con. Quarterly Report

The report of the Ray Consolidated Copper Co. for the first quarter of 1916 shows a production of $15,801,568 lb. of copper—4,164,043 lb. in January, 5,539,408 lb. in February and 6,098,117 lb. in March. In addition to the copper from concentrating ores, 608,540 lb. was contained in ore smelted directly, making the total copper output 16,410,108 lb. Total ore milled was 745,940 dry tons, an average of 8,197 tons daily, assaying 1.631% copper. Milling cost was 57.59c. per ton, and mining and coarse-crushing cost was 69.23c. per ton, 5.02c. of which was for coarse-crushing.

Average net cost of copper per pound was 10.579c., including 12½c. per ton for mine-development cost, and after crediting dividends of the Ray & Gila Valley R.R., revenues from gold and silver and all other miscellaneous income. Total of profit and income was $2,205,547, leaving a net surplus of $1,416,245 after paying dividends of $789,302. Earnings are based on 24.598c. per lb. for copper. All unsold copper was carried at 13.5c. per lb. The ninth quarterly dividend of 50c. per share was paid on Mar. 31, a total of $788,564.50, and $737.50 was paid as part of the eighth dividend on 1,475 shares, the result of conversion of bonds delayed in transit on account of European conditions.

Nevada Con. Quarterly Report

The report of the Nevada Consolidated Copper Co. for the first quarter of 1916 shows a production of 6,157,862 lb. of copper in January, 6,436,853 lb. in February and 6,565,559 lb. in March, a total of 19,160,274 lb. The tonnage of ore treated was 827,880, averaging 1.66% copper. The cost of copper, including Steptoe plant depreciation and all charges except ore extinguishment, and after crediting miscellaneous income, was 9.65c. per lb. Earnings are computed on a basis of 23.478c. per lb. for copper, and all unsold copper is inventoried at 13.5c. per pound.

The surplus for the quarter was $1,782,083, after paying the twenty-fifth dividend of 37½c. per share and extra dividend No. 4 of 12½c. per share; $142,360 was set aside for plant and equipment depreciation and $83,498 for ore extinguishment, leaving a net credit to earned surplus for the quarter of $1,556,224 and a balance of $6,405,780 in earned surplus.

Chino Quarterly Report

The report of the Chino Copper Co. for the first quarter of 1916 shows a production of 5,316,975 lb. of copper in January, 4,617,220 lb. in February and 6,333,255 lb. in March, a total of 16,267,450 lb. The total amount of ore treated was 714,400 tons, containing an average of 1.8719% copper. Average extraction was 60.82%, or 22.77 lb. of copper per ton milled. Of concentrates, 58,073 dry tons was produced, averaging 14% copper. From shipping ore 47,014 lb. of copper was produced.

The cost per pound of net copper produced was 8.95c., an increase of previous cost due to the lower grade of the ore treated. The total net income was $2,746,987, leaving a surplus of $1,659,512 aftr paying $1,087,475 in dividends. Earnings were based on 26.566c. per lb. for copper and all unsold copper on hand and in transit at the end of the period is inventoried at 13.5c. per lb. The dividend for the quarter was $1.25 per share—at the rate of $5 yearly.

Potash in Lake Muds of Western Utah

Potash in large proportions is present in the brines and muds of the Salduro Marsh, a sink in the Salt Lake Desert, about 60 mi. west of the southwest edge of Great Salt Lake. From the clays underlying the salt body which covers the marsh, the United States Geological Survey collected samples at depth of 8 to 12 ft., in which the dissolved salts were found to contain from 2 to about 3½% of potash, and 2¼% was found in the soluble salts at a depth of about 4 ft. According to analyses made by the Survey, the brines and muds from the Salduro Marsh contain considerable magnesium chloride as well as chlorides of potassium and sodium, and so are similar to the German potash deposits.

Details of Practical Mining

Filling Blocks for Idler Wheels

By John F. Spedding*

At many of the mines on the Lake Superior iron ranges, the hoists are situated at considerable distances from the shafts, and the ropes are supported between drums and head sheaves, on idler wheels similar to the one shown in the accompanying sketch, Fig. 1. The metal wheel rim is "filled" with a number of wooden blocks, as shown, and the ingenious method of cutting the block curves in use at the mines is the subject of these notes.

The blocks are first cut to the correct size, except that the two sides that have to be curved are first cut straight, and just large enough to allow the cutting of the curves to the proper size demanded by the wheel rims.

Two hardwood forms, *A* and *B*, are attached to the table of the band saw, as shown in Figs. 2 and 3. The block is first put into form *A*, Fig. 2, and pressed against the saw which cuts a circle of 14-in. radius. The

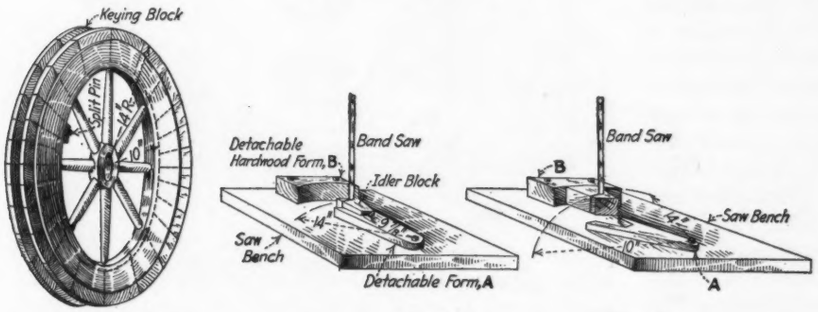


Fig. 1 Fig. 2 Fig. 3

FIGS. 1 TO 3. RAPID SAWING OF FILLING BLOCKS

block is then taken out of form *A*, and the curved face just cut is pressed to the corresponding curved face of form *B*, as shown in Fig. 3, and as the block is moved forward, the saw cuts the circle of 10-in. radius. The operation is rapid for cutting the very large quantity of blocks used annually and is the most satisfactory method known to the writer.

Changes in Compass Direction

According to L. A. Bauer, director of the Department of Terrestrial Magnetism, Carnegie Institution of Washington, in a paper presented at the 100th anniversary of the United States Coast and Geodetic Survey, the changes in compass direction reach very appreciable amounts with the lapse of time. The compass even changes its direction between morning and afternoon by an amount appreciable in accurate land surveying. During a so-called magnetic storm the compass direction may change suddenly by a degree or more. All such fluctuations are recorded at the magnetic observatories of the Survey, and the information is published promptly and made readily accessible to all interested.

The assumption frequently made by surveyors that the compass has changed its direction regularly at the rate of 3 min. per year or 1 deg. in 20 years, is not borne out by the data of the Survey. At the present time, for example, in the New England States the north end of the compass is moving west at the rate of about 6 min. per annum. In Porto Rico this westerly motion is as much as 10 min., and along the northeastern coast of Brazil it is about 16 min. Thus, instead of a change of 1 deg. in 20 years, there may be a change of 1 deg. in 10 years or even in five years or less, depending entirely upon geographic location.

First-Aid Treatment of Cases of Gas Poisoning

In all cases of gas poisoning prompt and efficient first-aid treatment is of the greatest importance. The records show that the practical knowledge of rescue and first-aid methods in these emergencies still leaves a good deal to be desired. This state of affairs will continue until all mine managers set themselves to make a well-equipped underground first-aid service an integral part of the routine working organization of the mine. Several of those attempting rescue, working with misdirected heroism, have in the past lost their lives, and many more have been temporarily overcome, through ignorance or heedlessness of the risks they have run, or sometimes from lack of provision of adequate means of local ventilation. The following points are suggested by L. G. Irvine, in the *Medical Journal of South Africa,* September, 1915, to be observed in attempting rescue:

1. When gas is encountered, the first thing to do is at once to turn compressed air into the place in which it has occurred and to keep it turned on throughout. This at once supplies with purer air those overcome and makes it safer for rescuers to enter the danger zone. It seems an obvious precaution to take, but neglect to do so has not infrequently resulted in disaster to those attempting rescue and in fatal delay in extricating those already overcome. No one should enter the danger zone until it has been well blown out for several minutes.

2. No man must enter the danger zone alone. Loss of life has occurred from this. Four men are the proper number to form a rescue party, so that if one is disabled, the others may be able to help him. Men who have already been engaged in rescue work should not enter the danger zone a second time if fresh men are available.

3. Rescuers should carry with them one or two candles to test the air, and also electric lamps, or failing these, acetylene lamps. Never take it for granted that the air

*Mining engineer, P. O. Box 290, Ely, Minn.

is safe because candles continue to burn, but always regard it as an urgent danger signal if candles burn low or go out. If this happens, rescuers should at once withdraw, and wait until the place has been more thoroughly blown out, unless rescue can be effected immediately and easily.

4. The next thing to do is to bring the affected man as quickly as possible to the nearest place where the air is fresh, and then at once to attend to the breathing. To bring the man to the surface before commencing treatment will, in bad cases, give that treatment little chance of success, and in cases where artificial respiration is required the delay will render treatment hopeless. Yet this sort of thing still happens.

Routine first-aid treatment recommended is as follows:

1. In slight cases where the man is conscious and quite able to swallow, the usual treatment is to give a dose of emetic (copper or zinc sulphate are commonly employed), and when that has acted, to follow with a dose of sal volatile. This procedure is to be adopted both in cases of carbon-monoxide poisoning and of suspected nitrous-fumes poisoning, the object being that the act of vomiting will help to remove mucus and gas from the lungs. There is no doubt that effectual vomiting gives great relief and is a valuable safeguard against after-effects, particularly in nitrous-fumes poisoning.

2. In all cases of carbon-monoxide poisoning of any severity oxygen should be administered.

3. When the man is unconscious oxygen should invariably be given and persevered with until consciousness is restored. When breathing is obviously failing, artificial respiration must be employed as well. Either the Sylvester or Schäfer method may be used. The former is commonly more convenient on the wet and uneven surfaces of mine ground, but the latter is more effectual and should be used when circumstances permit. In desperate cases, where breathing has ceased, the use of artificial respiration may sometimes be possible on the spot where the man is first found, provided that the place has first been well blown out. To do so requires courage and judgment, but it has saved life in at least one case within my knowledge.

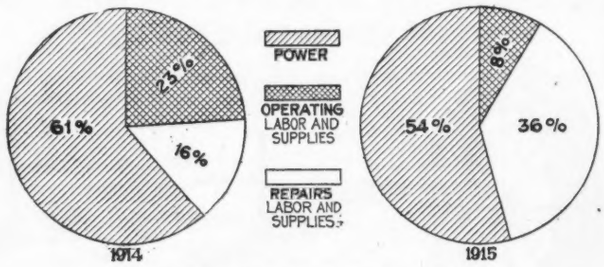
4. The man must be kept warm throughout by extra covering, friction of the limbs, etc. He must not be allowed to exert himself too soon, since the carbon-monoxide poisoning exertion may readily cause a dangerous exaggeration of the condition. On no account, even in comparatively slight cases, should the affected man be allowed to walk home. Hot strong coffee should be given, and alcohol should be avoided.

5. All cases of carbon-monoxide poisoning of any severity should be sent to hospital, and this rule should invariably be followed where the circumstances suggest that nitrous-fumes poisoning may have occurred. It is most important to keep these cases under observation, since the danger of acute symptoms setting in after apparent temporary recovery is always present. The medical attendant of the patient should be notified in all cases of exposure to gas, particularly when poisoning by fumes is suspected.

A word about emetics. Those used are not always to be relied on to produce prompt and efficient emesis, and if they do not do so, may cause nausea and depression. In slight cases of carbon-monoxide poisoning two-dram doses of bicarbonate of soda have been found a useful substitute. The eructation of gas which it causes acts in a similar way to the act of vomiting. For the more severe cases, and in all cases of nitrous fumes poisoning, the use of apomorphine hypodermically is suggested. This drug is more reliable, and produces a prompt and not too prolonged emesis. Apomorphine should be preceded or followed by an injection of strychnine or (preferably) pituitrin.

Old Dominion Pumping Cost*

In the first six months of 1915 6,750,000 tons of water were lifted from the 10th, 12th and 14th levels of the Old Dominion mine at Globe, Ariz. During this period 99,000 tons of ore were hoisted from the mine; in other words, for every ton of ore extracted and hoisted, the company had to pump out of the mine 68 tons of water, a proportion of water to ore that is obviously not conducive to cheap mining. During the first half of the year the pumping costs amounted to 29% of the total underground, hoisting and surface expense. Details of the pumping costs during the flood period were so abnormal as to have no particular value, but the total pumping expense, the operating labor and supplies amounted to 10%, power to 54% and repair labor and supplies to 36%. In the previous year (1914) operating labor and supplies amounted to 23% of the total, power 61% and repair labor and supplies 16%. This is shown graphically in the accompanying diagram. The repair expense consists of repairs, labor and material to steam lines, water columns, pumps, sumps and drain tunnel, as well as the installation of emergency pumps, air lifts, etc. In the power expense, which is the heaviest individual item of the pumping costs, fuel oil is practically 87% of the total, which, during the period from Jan. 1 to June 30, 1915, would make the fuel-oil expense 47% of the total pumping costs.



DISTRIBUTION OF PUMPING EXPENSE

Rifling of Diamond-Drill Cores

In a paper to be presented at the Arizona meeting of the American Institute of Mining Engineers, September, 1916, Walter R. Crane gives an account of his investigations into the rifling in diamond-drill cores. This is of scientific rather than economic interest. The conclusions reached by the investigations are briefly summarized by him as follows:

1. Rifling of cores is produced by torsional vibration of the rods.

2. The formation of multiple threads, or a number to the turn, is determined by the intensity of vibration, character of the cutting medium and the core.

3. The pitch of the threads is determined by speed of rotation of the rods.

*Excerpt from paper entitled, "The Water Problem at the Old Dominion Mine," by P. G. Beckett, Globe, Ariz., to be presented at Arizona meeting of A. I. M. E., September, 1916.

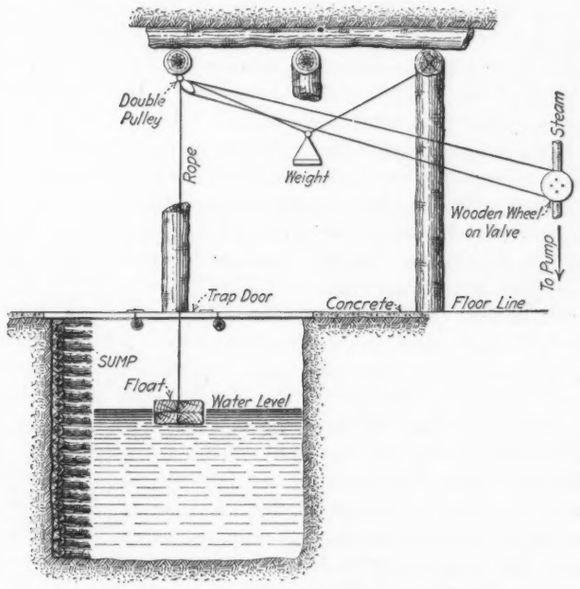
4. The size and length of rods probably act only indirectly to modify the size, shape and pitch of threads.

As rifling of core is produced by rotation and varies in prominence with the intensity of vibration, it is possible to prevent or very materially reduce the vibratory action of the drilling mechanism by reducing the speed of rotation of the rods. This method of procedure would undoubtedly be much less difficult and troublesome and far more efficacious than greasing the line of rods.

Float Control for Mine Pump

By D. E. Charlton*

A simple and efficient method of float control for a mine pump, which has been effectively used at one of the Mesabi Range mines, is shown in the accompanying illustration. The sump, which underlies a portion of the underground pumproom, is 10x12 ft., by 10 ft. deep, excavated in ore and timbered. Under ordinary conditions the water level in the sump is about 4 ft. below the concrete floor of the pumproom. A 10-in. by 2x2½-ft. wooden float is attached to a ⅜-in. manila



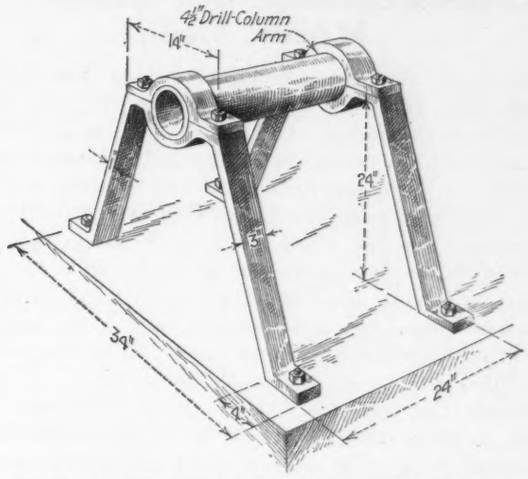
FLOAT CONTROL FOR MINE PUMP

rope passing over a double-wheel pulley placed directly over the sump center. The planked-over sump has a hinged door slotted to pass the rope. From the pulley the rope is extended to a 12-in. wooden wheel which is fastened directly to the steam-inlet valve on the pump, a distance of about 15 ft. This wooden wheel is of 1½ in. thickness and grooved ½ in. deep on the circumference. The rope is given a double turn around the wheel and carried back to the other wheel of the double pulley, passing under and over and thence to one of the caps forming the roof of the station. A counterbalance of sufficient weight to regulate the passage of the steam into the pump when actuated by the float is applied on the rope between the pulley and the point of fastening. As the float rises or falls, the steam flow is reduced or increased, thus regulating the rapidity of the pump stroke.

*Mining engineer, Virginia Mining Co., Virginia, Minn.

Stand for Machine-Drill Repairing

When anything "goes wrong" with a machine drill underground, it is sent out to the machine shop, or should be, for repairs. Usually the drill is placed upon a bench, where it is taken apart and repairs made. This is very inconvenient, for the drill is too high; the bench



STAND FOR REPAIRING MACHINE DRILLS

is usually against a wall, making the drill accessible from one side only and therefore necessitating the turning of the drill end for end, perhaps several times; and the drill will wobble, making the work slower and more difficult.

To make this work easier, the stand shown in the accompanying illustration was designed. This stand consists of a column arm held about 2 ft. from the floor by two standards of 1x3-in. flat iron, bent as shown and fastened rigidly by two caps of the same material bolted to the standards. The standards are bolted to the floor. A column-arm clamp is fastened to the column arm and the drill to the clamp. The drill is then held rigidly at a convenient height for work; it is accessible from all sides and can be swung in any direction desired by merely loosening the clamp nut.

Drifting with Jackhamers at the Prince Consolidated

By James Quirk*

The Prince Consolidated mine during March, 1915, mined slightly over 15,000 tons, averaging about 500 tons per day. The entire tonnage came from 8x7-ft. development drifts, each requiring twenty 5½-ft. holes to break and averaging 34 tons broken per drift per machineman, and requiring two muckers to clean up the round. Fifteen jackhamers were used to break the daily production of 500 tons. The ore is an iron-manganese replacement of alternate limestone and shale beds.

A record in drifting was established by a machineman working on a bonus. In 22 shifts, an 8x7-ft. drift was advanced in Cambrian shale 152 ft., averaging nearly 7 ft. per shift.

Our daily output of 350 tons at this writing requires but 10 headings, all drifts, using only 10 jackhamers. the only drills employed.

*Superintendent, Prince Consolidated Mining and Smelting Co., Ploche, Nev.

Company Reports

Seneca-Superior Silver Mines, Ltd.

Report of the Seneca-Superior Silver Mines, Ltd., Cobalt, Ont., for 1915, shows that during the year silver was sold at an average of 51.29c. per oz., as against an average of 53.02c. per oz. in 1914, entailing a loss of about $25,000 due to the low price of silver coincident with the war. Notwithstanding the higher cost of explosives, steel and mining supplies of all kinds, silver was extracted at a cost of 23.45c. per oz. as against 30.53c. in 1914. The reduction in cost was due to the fact that exploration work was reduced to a minimum, and also to the fact that a great part of the ore produced came from the stopes that were filled with ore broken in former years.

During the year 2,047,150.2 oz. of silver was produced, an amount slightly in excess of the ore reserves at the end of 1914. The reserves at the end of 1915 consist for the most part of broken ore in the stopes, detached portions of ore in floors and pillars and low-grade ore below the fourth level and in the dump. It is estimated that this will yield between 400,000 and 450,000 oz. of silver. The accompanying table shows a complete cost of operation and administration.

OPERATION AND ADMINISTRATION COSTS

	Gross	Per Oz.
Smelter loss	$20,999.65	1.03c.
Royalty	280,860.94	12.25c.
Marketing	47,100.99	2.30c.
Operation	122,986.18	6.01c.
Exploration	9,891.21	.48c.
Depreciation	7,600.73	.37c.
Administration	20,649.60	1.01c.
Total cost	$480,089.30	23.45c.
Profit	569,990.92	27.84c.
Gross value	$1,050,080.22	51.29c.

There were practically no extensions to the plant during the year, and expenses were confined to operation and maintenance. The mill was in constant operation, running three 8-hr. shifts a large part of the time. The costs (operating expenses) for four years have averaged 10.6c. per oz., the maximum for any one month being 18.7c. and the minimum 3.7 cents.

The Brunswick Consolidated

The Brunswick Consolidated Gold Mining Co., Grass Valley, Calif., for the year ended Jan. 27, 1916, reports a total production of $223,556 from 22,004 tons of ore treated. The total gross income, including miscellaneous receipts, was $226,820. Expenditures for all purposes included $39,751 for a new mill, and other improvements amounted to a total of $189,071, leaving a net profit of $37,749, or $1.72 per ton of ore treated. For 1914 the total cost was $10.45 per ton, or $8.45 per ton, exclusive of shaft sinking and improvements. During 1915 the operating cost was $6.78 per ton, with $1.81 for improvements, making the total cost $8.59 per ton. With the new mill working full capacity it is expected that the working cost will be reduced to less than $6 per ton. Three dividends, totaling $71,151, were paid during the year. Cash reserve was decreased $36,605. At the old mill the stamp duty was 2.616 tons per day per stamp as compared with 2.326 tons in 1914. The increase was due largely to increase of fines in the ore sent to the mill. The new stamp mill crushed 2.988 tons per day per stamp.

Hedley Gold Mining Co.

The Hedley Gold Mining Co., owning the Nickel Plate and Sunnyside mines, on Nickel Plate Mountain, at Hedley, B. C., in its report for 1915 shows that the mill has treated 74,265 tons of ore, all mined from the Nickel Plate property. Most of the diamond drilling was done last year, the object being to determine just what kind of ore could be found in the lime-silicate beds below the present stopes. This work, although not complete, was satisfactory, indicating a tonnage of 88,400 and a milling value of $12.50 per ton. A crosscut 200 ft. long was run from the No. 4 level of No. 5 incline, which intersected this ore, and it is now being mined.

Several small payable orebodies were discovered in other sections of the mine, and the opening of others is expected. The reserve tonnage above the No. 4 tunnel level of the old workings is 35,025 tons averaging $8.52 per ton, and below the No. 4 tunnel level is 388,527 tons averaging $10.55 per ton.

Conditions in the lower levels of the mine have, within the last two years, changed considerably. While the orebodies are larger than the upper levels and stronger in every way and, contrary to the rule at most gold mines, maintain at least the same grade per ton, the specific gravity of the ore has increased so that it requires only 10 cu.ft. to make a ton, where formerly it required more than 12 cu.ft. This is caused by the increase in arsenopyrite and adds considerably to the cost per ton of ore milled, since the concentrate tonnage has increased from 3,831 tons in 1913 to 6,218 tons in 1915. This condition, together with war prices and miners' wage increases, tends to reduce profits.

Attempts have been made to determine the most profitable method of treating this ore. For two months 25% has been treated by total cyaniding with satisfactory results. As soon as this system is adopted, the costs will reduce and the surplus increase correspondingly. On account of the ore change it was found necessary to add more machinery to the cyanide plant. This was done, and it was put in operation the latter part of October, the total expenditure being $34,291. Further expenditure for additions to the plant amounted to $10,976. The whole plant has been brought up to the highest efficiency. Power plant, mill, tramway, flumes, etc., were put in good shape, and when the additions planned for 1916 are made at an estimated cost of approximately $60,000, it should run with but few repairs for many years.

The net profit for the year was $374,745. Dividends paid aggregated $300,000, or 25% on the issued capital stock. Undivided profits, after all dividends were paid,

amounted to $435,070 on Jan. 1, 1916; $6,329 was expended for perfecting the hydro-electric plant, the sum being charged to capital account; $3,136 was spent in completing the installation of a new jaw crusher, and $1,512 was expended on a new house for mine superintendent and $34,291 on additions to the cyanide plant. All were charged to capital account.

Beaver Consolidated Mines, Ltd.

The report of the Beaver Consolidated Mines, Ltd., Cobalt, Ont., for 1915 shows that a total of 5,211 ft. of development was performed and that 8,480 cu.yd. of stoping was done.

The capacity of the mill was increased, and it is now treating from 125 to 150 tons per day. There is a large quantity of surface dump which will probably be milled during this year. Broken ore in fills underground, ready for the mill, amounts to 34,332 tons. During the year 30,093 tons of ore was treated, recovering 474 tons of concentrates which produced 349,900 oz. of silver. Production was curtailed owing to the low price of silver. The total recovery, including ore shipped or milled, amounts to 746,310 oz. of silver.

The company recently took an option on the stock of the Kirkland Lake Gold Mines, Ltd., which owns 365 acres of land in the Kirkland Lake district in the Township of Teck. On the McKane lot of the Kirkland Lake property is a fully equipped plant consisting of two boilers, small compressor and sufficient mine buildings. A vein has been discovered and proven for a distance of 1,400 ft. A shaft was sunk on the vein to a depth of 79 ft., from which their engineer reported assays varying from $46 to $262 per ton. The agreement with the Kirkland Lake Gold Mining Co. provides that the Beaver shall spend at least $2,000 per month on development for the next year, with option of taking it up at a fixed price at the end of that time.

On capital account there has been invested $11,646, and two dividends of $60,000 each have been paid. Exclusive of ore in dump and in the mine, they have on hand bullion in store and due from smelters aggregating an estimated value of $170,278. Although much silver has been stored, some has had to be sold at low prices to meet current expenses, but a large quantity is being held in expectation of much higher prices.

Victoria Copper

The Victoria Copper Mining Co., Victoria, Mich., for 1915 reports a production of 1,499,695 lb. of copper at a cost of about 16.5c. per lb. Total receipts were $317,087, of which $25,766 came from assessments. Expenditures amounted to $245,431. Balance of quick assets over current liabilities was $112,280.

There was 133,984 tons stamped, indicating a yield of about 11.2 lb. of copper per ton. Development work totaled 4,862 ft., making a grand total of 63,971 ft. of openings on the property. The new shaft is completed to the 12th level and a temporary hoist was expected to be in operation there by Feb. 1, 1916. This will more than double the present hoisting capacity.

The Union Copper Land and Mining Co., Michigan, reports some sales of timber concluded during 1915, and shows a net cash balance Jan. 1, 1916, of $13,745.45. No sale of mineral lands was made; the total land holdings remain unchanged.

The Seven Troughs Coalition Mining Co., of Lovelock, Nev., for the year ending Dec. 31, 1915, reports ore returns, $397,069; bullion in transit, $11,004.33; interest, $3,453; total income, $41,111,527. Total expenses for the period were $238,652; and excess income over expenses, $172,874. Four regular and one extra dividends were paid during the year, the total of which was $180,380.

The Report of the Plymouth Consolidated Gold Mines, California, for 1915 states that the quantity of ore treated amounted to 129,500 tons, yielding £133,549. The working expenses amounted to 10s. 7.16d. per ton, and development expenditure to 1s. 11.08d. per ton, or a total of 12s. 6.24d. per ton, and the gross profit to £51,465. £5,709 is written off for depreciation, as well as the balance remaining to the debit of development and administration expenditure account, £4,485, and after making provision for income-tax, the net profit was £39,214, which, with the amount brought forward, makes £39,434, out of which dividends amounting to £36,000 have been paid and £2,534 carried forward.

The South Lake Mining Co., Houghton, Mich., for 1915 reports an income of $119,672, of which $108,324 was received from the sale of stock. The total expenses were $102,714, leaving a balance of quick assets $16,958. During the year 3,933 tons of rock was stamped for this company at the Franklin mill, which yielded 61,637 lb. of refined copper, indicating an average yield of 15.4 lb. per ton. This rock was sent to the mill in the nature of a test for the purpose of obtaining some definite information as to the average grade of rock that could be mined in quantity from all the lodes. Total development amounted to 4,276 ft., of which 1,209 ft. was crosscutting and 3,067 ft. was drifting.

Mason & Barry, Ltd. (S. Domingos Mine, Portugal) report for the year 1915 a total quantity of ore broken and raised at the mine, 192,942 tons, as against 259,238 tons in 1914; shipment during the same period, inclusive of ore from cementation work, amounted to 168,118 tons, as against 257,616 tons in the previous year. The profit and loss account for the year shows a gain of £59,737, of which it is proposed to devote £55,551 to a 30% dividend. There was written off for depreciation £10,000, nearly half of which was to cover new works and plants added to captital account during the year. The rate of exchange between England and Portugal during 1915 was very favorable to operation.

The Superior & Boston Copper Mining Co., Globe, Ariz., for year ended Sept. 30, 1915, received from all sources $73,638 and spent $103,394, leaving a balance on hand of $29,529 as compared with a balance of $59,285 on Oct. 1, 1914. The mine produced ores to the value of $96,695 during the year, of which $42,164 was produced by leasers. Development work consisted of 1,457 ft. of drifts and crosscuts and 637 ft. of raises. The company owns 800 acres adjoining the Arizona Commercial and United Globe properties on the east, which is fully paid for. A program for the development of sulphide ores at and below the 1,200-ft. level has been definitely outlined for 1916. The production to date amounts to a little over $1,500,000 from oxidized ores mined in the upper levels.

The Report of the Mount Morgan Gold Mining Co., Queensland, Australia, for the half year ended Nov. 28, 1915, shows that the ore raised during the period was 203,767 tons of Mount Morgan ore, and 26,270 tons of Many Peaks ore. The concentrating plant treated 83,985 tons of ore for a production of 24,022 tons of concentrates. Of these, 18,431 tons were smelted, the balance being on hand at the close of the term. Combined tonnage of material treated at the smelting plant, amounting to 162,867 tons, yielded 4,310 tons of fine copper, and 62,779 oz. of gold. A new calculation of ore reserves has been ordered, which is expected to be completed in time for the next report.

Total revenue for the period was £647,038 8s. 8d., and expenditure charged to profit and loss, including development and depreciation, was £478,395 13s. 5d. Balance of undivided profits brought forward from last year was £186,992 1s. 5d. Dividends paid during the year amounted to £150,000, leaving a total balance carried forward to next account of £205,634 16s. 8d. In the concentration plant the table concentrates accounted for 31.89% of the copper, and 40.82% of the gold, while flotation concentration accounted for 56.6% of the copper, and 31.76% of the gold. This makes a total extraction of 88.49% copper, and 72.58% gold. Working cost per ton of Mount Morgan ore treated, including development and realization charges, are 42s. 5.54d., as against 40s. 3.8d. per ton for the previous half year.

Correspondence and Discussion

Oxyacetylene vs. Arc Welding

It is a rather difficult matter to compare arc and oxyacetylene welding, inasmuch as each process presents certain advantages as well as disadvantages.

From the standpoint of portability, both to the mine and from place to place on the job, the arc is superior. It is the usual practice in oxyacetylene work to use a tank of oxygen and an acetylene generator. Oxygen tanks are exceedingly cumbersome, and where it is necessary to transport them any great distance, especially by mule-back, this process becomes almost prohibitive. An acetylene generator need be installed but once, but the storage of carbide presents certain difficulties, especially after a can has been once opened. On the other hand, the arc process requires only a resistance element which is small and seldom weighs more than 50 lb. There is, of course, no comparison between the rubber tubing used for oxyacetylene work and the cable used in arc work. Rubber tubing is far lighter, but its life is much shorter. However, a complete arc outfit is very much lighter than an oxyacetylene outfit.

In point of simplicity there is little choice between the two methods. The average mine mechanic possessing ordinary intelligence can pick up either process with equal facility. There is this to be said for the arc process, however: A few electrical connections are all that are necessary, whereas with the oxyacetylene process there are valves to get out of order, pressure to regulate, rubber hose to get torn and the ever-present danger of an explosive gas.

A year's supply of electrodes and fusing wire can be kept almost any place and requires little space. If the apparatus is to be moved any great distance, the arc process again comes into favor, as it occupies considerably less space and is much lighter. From the viewpoint of safety the arc process has the advantage, as it operates with current that is safe to handle. With acetylene there is always the danger of a leak with subsequent probability of an explosion. Then, too, acetylene, if leaking, is as bad to inhale as blackdamp. If the oxyacetylene torch is properly controlled, it presents a reducing atmosphere, whereas the conditions surrounding an arc are of an oxidizing nature. However, this is a relatively minor consideration except for very fine work.

If we now leave aside all other considerations and compare the two methods from the standpoint of application, there is little to choose from. For small repair work where the working surface is small, the oxyacetylene process is superior, but for larger jobs the arc is much quicker and does a cleaner job. In the matter of welding cast iron not much can be said in favor of either process. In the hands of an expert fairly good work can be done by either method, but the novice will have his troubles regardless of process, as cast iron is one of the most difficult of metals to weld. However, with practice the average mine mechanic should be able to do satisfactory work in cast iron with either process. JAY H. SCHMIDT.

Cleveland, Ohio, Apr. 28, 1916.

A Symposium on Management*

As an auditor to a large mining and smelting concern, I should like to submit my views as to various improvements that could be made in the operation of the mining and smelting end of similar corporations.

My colleagues who are in charge of the mining and smelting end of my particular company are, in my opinion, altogether too absorbed in what they consider the practical end of their operations, and do not give sufficient consideration to the results as they affect the books of the company. For instance, in my opinion it is quite unnecessary to use underground the amount of timber that is demanded by the mining men, and it would be much simpler, from my point of view, if the smelter man were to make 100% recoveries, which would obviate the necessity for immense calculations in distributing metals among the slags, flue dust, products, etc.

Various recommendations that I have made from time to time, such as the addition of the flue dust to the hot slag and the resmelting of the resulting product, have met with scant courtesy, and my repeated suggestions for the formation of a special committee consisting of members of the clerical department, to deal with improvements in the mining and smelting operations have, I am sorry to say, been rejected with scorn.

I have to point out that there is no necessity for applying this same scheme to the work of the clerical department, as there is no room for any improvements in that direction.

If you could bring your vast influence to bear upon the faded intellects of such men as I have just indicated, I think it would be for the good of the country.

CALCULASS.

The editor of the *Journal* has referred to me for comment the modest and unassuming contribution signed by Calculass.

I think it possible that Calculass, after years of study, might be capable of running a donkey engine, but I am afraid that a too frequent use of a comptometer has curdled any gray matter that he originally possessed.

He does not seem to appreciate that it is quite sufficient work for me and for men of my particular calling to make the best attempt possible to treat the miserable grade of so-called ore supplied to my smeltery by the underground department, without having to consider the futile and asinine suggestions forwarded by the head of a department whose work is already done for him by the overworked staffs of the other departments, and who seems to think—because of the present miserable and unsatisfactory methods of organization existing in this company, his particular department is an unwelcome necessity and almost an excrescence—that he put the ore underground and originated methods for treating it, and in fact is the whole show.

*From the archives of "The Daily Fume."

I have no doubt that it is our auditor, who hides his name and fame under a *nom de plume,* which he has so characteristically adopted, and that he could easily make more than 100% recovery in the smeltery so long as he was allowed to be his own assayer, and provided all his slag, flue dust, etc., were used for filling up swamp lands where subsequent assaying of these materials would be impossible.

Finally, I would point out that if the manager of the mine would adopt some reasonable method—which could be easily devised—for differentiating between waste rock and valuable ore; it might be possible to approximate the recoveries requested by our worthy auditor; but so long as the underground department continues in the habit of forgetting that it has eyesight immediately it goes underground, we poor smelters cannot be expected to do more than the 98.1% recovery we are now achieving.

SLAG BEETLE.

I am the manager of the underground department of a large mining and smelting corporation and have read with interest the effusions signed by Calculass and Slag Beetle.

Judging from the tenor of their remarks, it would be imagined that the troubles they have are entirely due to the sins, omissions and commissions of the miner and the mining department. I imagine Calculass and Slag Beetle are the mental defectives who are pretending to manage certain departments of my own company. They have ,apparently, no appreciation of the fact that were it not for the wonderful skill and results of the mining department, their puny little efforts would result only in disaster to all concerned.

Calculass and the whole of the staff of his department are, after all, purely figure manipulators, who seem to consider that 95% and over of all the fixed charges of this corporation should be debited against the underground department, and they, in the magnitude of their ignorance, have been trying to take a hand in the purchasing of supplies for us. They actually suggested the other day that the waste timber from the manufacture of matches could be properly used underground as props in our main drives. I presume they also think that toothpicks would make very good driving laths. But in any case their particular department is practically beneath contempt, and if it were not for the fact that the general superintendent somehow considers that they are in a measure necessary, I for one would vote that all the figuring and calculations showing the results of the mining department should be worked out by that department, and I feel certain that under these circumstances costs would be shown lower, even if no more ore were produced.

The nasty, dirty, insinuating remarks contained in Slag Beetle's letter are only an example of what must be expected from the smelting department that invariably questions the tonnage and assay of all the splendid ore sent to it from underground. I verily believe that if we sent them pure smelted gold they would question its value and complain that we were debiting them with the airholes contained in the bars.

I would ask you, sir, what is the smelting department for? If we were to do everything that the smelting department thinks we should do, it would be out of a job. It seems to think that we have nothing else to do but remove every particle of waste material from the crude ore while it is underground. In addition to the complaints that we invariably receive from it, we have also to resign ourselves to the continual misrepresentation of facts which is daily set forth by the assay office. We can tell by the look of the ore how much valuable material there is in it, and yet, in spite of repeated requests, the assay office refuses to confirm what *we know* to be true.

I can only say in conclusion that if I had my way I would give each of the gentlemen to whom I have been referring one month's salary and suggest that they would find a better outlet for their energies sweeping the streets on the back corners of a city, and better results would be obtained by appointing the office boy in charge of the auditor's department, the latest arrived immigrant in charge of the smelting department, and a stoker off a tramp steamship in charge of the assay office.

I may say that I now feel better and beg to remain,

GANGUEITE.

Manganese vs. Chrome-Steel Roll Shells

In the *Journal* of April 1, 1916, there was published a note on "Manganese- vs. Chrome-Steel Roll Shells," by M. R. Percy, in which he says that he would like to have somebody's experience with manganese- and chrome-steel crusher plates. I give herewith the results of two tests on crusher plates of these two steels:

CHROME-STEEL JAW PLATES

Installed July 4, 1910, to Mar. 17, 1911, inclusive

Weight of set, lb.	921
Cost, f.o.b. mill	$86.93
Tons milled during period	70,206.20
Cost per ton milled	$0.00138

MANGANESE-STEEL JAW PLATES

Installed Mar. 18, 1911, to Jan. 22, 1912, inclusive

Weight of set, lb.	740
Cost, f.o.b. mill	$72.62
Tons milled during period	86,478.70
Cost per ton milled	$0.00084
Difference in cost, in favor of manganese steel, per ton milled	$0.00054

In another test, run at another property during the first part of 1914, chrome-steel plates crushed 48,736 tons of ore and manganese-steel crushed 99,451 tons of ore. In this case both plates were made from the same pattern. This test was run by reliable men, but they will not permit their names to be mentioned in connection with it. However, I can assure you that the data quoted are absolutely correct.

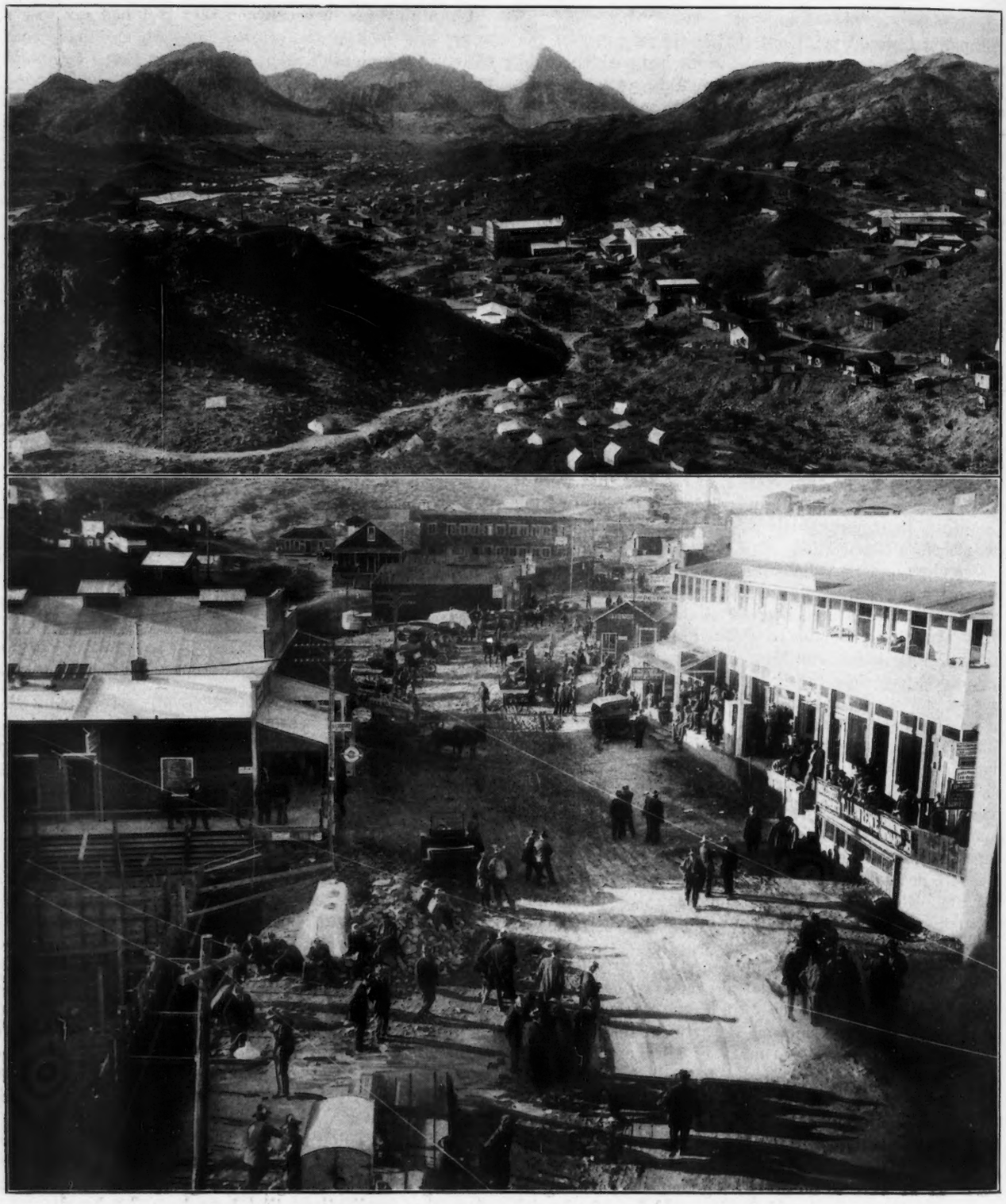
I want to take this opportunity to correct Mr. Percy's impression as to service obtained from manganese-steel balls compared with chrome-steel. There are practically no manganese-steel balls used at the present time, and I am familiar with a test that was recently run in which the manganese-steel balls gave slightly better service than chrome-steel. But their manufacturing cost is greater than for chrome-steel, making the latter more economical. However, the time may come when the manufacturing cost of manganese-steel balls will be reduced to a point where they may compete with chrome-steel.

At present I do not think that any of the manganese-steel manufacturers are giving much attention to the making of balls, owing to the great demand for steel for other applications that have been developed.

FRANK E. JOHNSON.

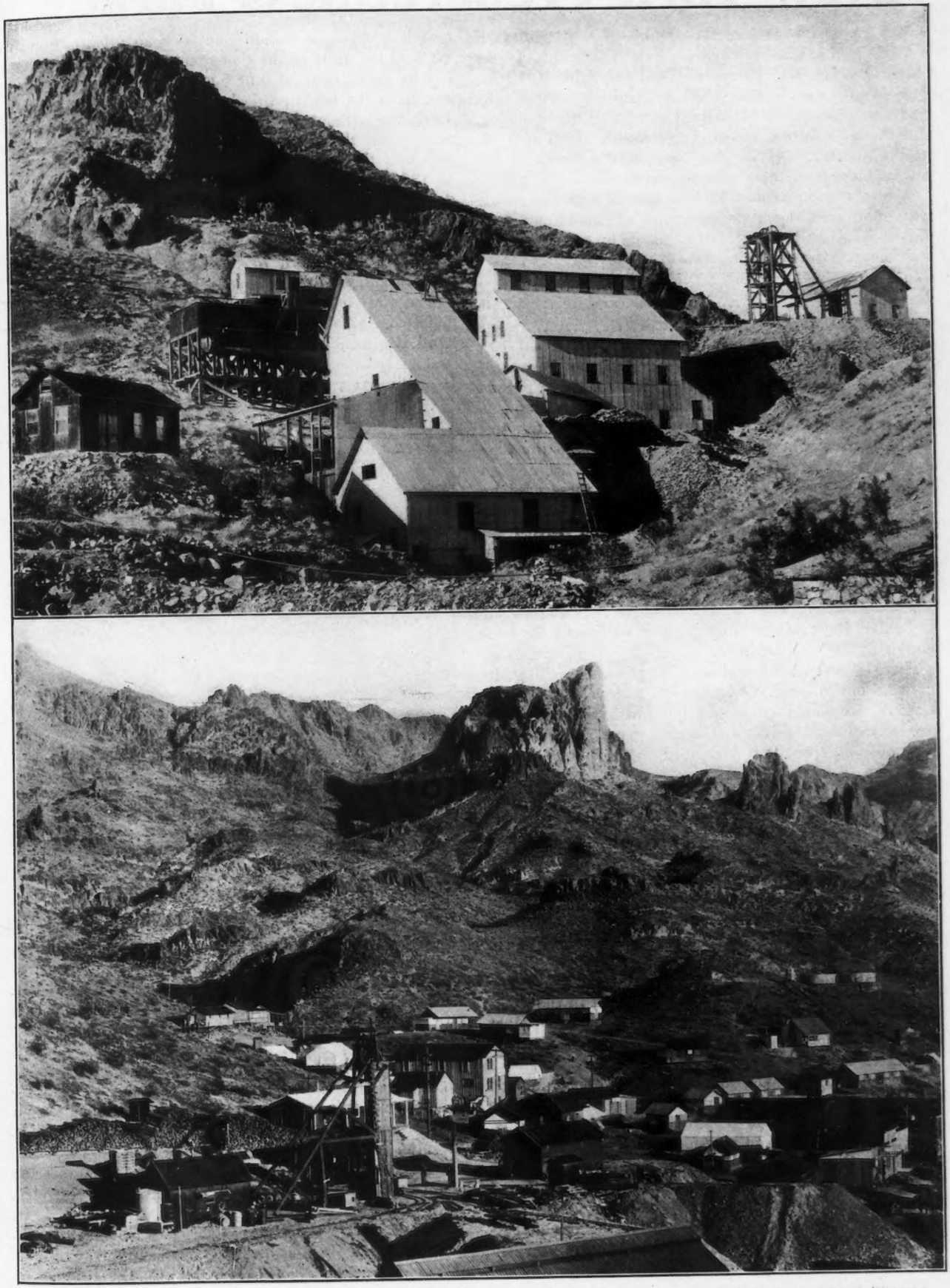
525 Newhouse Building, Salt Lake City, Utah, May 2, 1916.

Photographs from the Field



VIEWS IN THE NEW AND INTERESTING CAMP OF OATMAN, ARIZ.

The prosperity of this new gold district continues to attract attention. The upper photograph shows a general view of the town and vicinity. The lower is a view in the streets of Oatman



TWO OATMAN PROPERTIES, THE ORION MINING AND MILLING CO. ABOVE AND THE UNITED EASTERN BELOW

New York Preparedness Parade

The greatest parade in the history of the country, if not the world, was reviewed in New York, May 13, by Mayor Mitchel, Major General Wood and Admiral Usher. The parade was composed of civilians representing 64 trades or professions. It started at 9:30 in the morning, and the last platoon passed the reviewing stand at 9:40 in the evening. At no time was there a break in the line of more than three minutes' duration.

A careful compilation of the number of marchers, made with indicators by representatives of the New York *Times*, fixed the total at 125,683, made up as follows:

Male civilians (excluding bandsmen)	105,674
Women	3,287
National Guardsmen	7,994
Spanish War Veterans	728
Bandsmen	8,000
Total	125,683

This exceeded by 45,000 the largest parade that had ever been given previously, the Sound Money Parade of 1896, and exceeded by 50,000 the Business Men's Parade in 1908. Over 60,000 men had to be refused enrollment because of the inability to pass more than the above number by the reviewing officers within the allotted time.

There were no uniforms, no wheeled vehicles, and no horses except in the National Guard and those used by the Grand Marshal and his staff. But although civilian clothes were worn, almost every marcher carried an American flag, which, besides the battalion colors, made a sight impressive beyond mere superlatives.

The purpose of the parade was to impress upon the country at large, and to the pifflefists in Congress in particular, the overwhelming popular sentiment for adequate national preparedness.

There were 7,000 engineers in line, marching in platoons of 20, each platoon with a leader, and they without any doubt presented the finest appearance of any body of men in line and earned many plaudits from the 1,000,000 spectators who lined Fifth Avenue during the entire 12 hours.

They were led by the Naval Consulting Board, composed wholly of engineers from the national engineering societies, which includes eight members of the American Institute of Mining Engineers. Then followed the delegation from the Engineers' Club; then the other engineers, the mining engineers furnishing 10 platoons.

It was the first time the engineers of New York ever appeared in a body, and it was a most significant event in many ways. When W. L. Saunders, Thomas A. Edison, Pope Yeatman, A. S. Dwight, W. H. Aldridge, E. G. Spilsbury and many others will march afoot in the ranks of such a demonstration, it betokens a depth and weight of public opinion which ought to have an effect even on a Congressman.

The handling of such an army, with every unit on time throughout a 12-hour period, was an engineering feat—the direct result of preparedness. Col. Charles H. Sherrill was made grand marshal because of his experience with the other large parades mentioned and his especial fitness for the job. He chose for his staff and aides some of our best business organizers and National Guard officers, who commanded each regiment and battalion, all of whom were accustomed to handling men in large units and obeying orders. Those who witnessed the spectacle can little appreciate the amount of effort required in advance to build up such an organization; to marshal the units in the side streets; have them enter the line on time; turn off into side streets and be dismissed; and have the human tide keep on flowing regularly for 12 hours without hitch and without holding any unit more than the minimum time. The organizers know full well the size of the task imposed by the handling of 125,000 men—not a large army as armies go nowadays. They will not be alone in this realization. The effect of the parade will be beyond estimate at this time, but besides the demonstration of a public demand for defense it has shown to thousands the need of ample preparation when time is not the controlling factor.

The National Guard of New York to the number of 8,000 closed the parade with an inspiring column. The 22nd Regiment of Engineers with its combat train and

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THOMAS A. EDISON AND W. L. SAUNDERS, LAWRENCE ADDICKS IN BACKGROUND, LEADING NAVAL CONSULTING BOARD IN PARADE

ponton train, the balloon signal wagon, the armored motor car, and much other equipment, was an education to the layman as to the part the engineer takes in war.

The parade of the engineers forms a fitting climax to the military-engineering lecture course, which was the first organized effort of the engineers along this line, details of which have appeared regularly in the *Journal*.

Of our well-known mining men who were actively associated with this parade and in some instances gave their entire time to it for many days in advance, were: L. D. Ricketts, Bradley Stoughton, C. F. Rand, J. Parke Channing, Arthur S. Dwight, of the Military-Engineering Lectures Committee; Lawrence Addicks, W. H. Aldridge, Karl Eilers, H. W. Hardinge, J. B. F. Herreshoff, J. H. Janeway, S. J. Jennings, George F. Kunz, B. B. Lawrence, P. de P. Ricketts, E. G. Spilsbury, G. C. Stone, of the Honorary Parade Committee; L. D. Huntoon on the Equipment Committee.

Alaska Juneau Gold Mining Co.

The annual report of the Alaska Juneau Gold Mining Co. for the year ended Dec. 31, 1915, states that the sale of 400,000 shares of the treasury stock at the par value of $10 each was consummated, for funds to be expended for the further development and equipment of the property, which would enable the company to earn $1,400,000 per year. Since then the work of further developing and equipping the property has been energetically pushed and the development work to date confirms all estimates upon which the representations as to earning capacity were based. Other underground work has made such progress, that it can be positively stated that by the end of this year the mine will be able to supply 8,000 tons of mill ore per day.

Practically all ore and waste excavated as a result of the development and preparatory mining work during 1915 was sent to the company's 50-stamp Pilot mill with a recovery of $201,036 from 179,892 tons of material so milled. This work has enabled the company's engineers to experiment with different types of apparatus and to intelligently draw the flow sheet for the new mill.

The engineers, besides having the benefit of this experimental work on the Alaska Juneau ore, have been able to profit by the experience of the neighboring Alaska Gastineau mill and by the ball-mill practice of the Inspiration mill in Arizona, with the result that they have adopted the Inspiration ball-mill for the principal crushing work and have adopted the Deister rougher and slime tables for concentrating in the new mill.

Contracts for all the necessary machinery and supplies were let with the intention of having the mill in operation by January, 1917, but as the grading and foundation work were delayed several months by the severity of last winter, it is now estimated that the first section of the mill cannot be ready until March, 1917.

On Jan. 1, 1916, the cash on hand totaled $2,232,123, which sum is sufficient to take care of all outstanding obligations, to complete the mine preparatory work for an output of, and to complete the installation of all equipment necessary to mill, 8,000 tons of ore per day.

Details of Mine Operations

The most important development work of the year was done upon the North orebody on the No. 4 level. The work conformed to a general mining scheme previously decided upon, which embraced the undercutting of a section of the orebody about 700 ft. long by 250 ft. wide, driving intermediate levels, placing chute raises and bulldozing chambers at regular intervals, and the driving of about 18 raises from the back of the cut-out area to the level above. From these raises numerous powder drifts are to be run for the purpose of blasting and forcing the rock to cave as required. The main raise (No. 2) will provide a main thoroughfare for the upper levels of the mine, as well as additional ventilation.

In addition considerable work was done in the way of straightening the drifts which are used for the main haulage and in trimming the sides of Gold Creek tunnel and other avenues in the mine to facilitate the passage of the 10-ton cars which will be used in mining.

During the year a certain amount of stoping has been performed above the No. 4 level, not only to provide ore for the mill, but also to carry the stopes to a sufficient height to meet the requirements of the program. The total run-of-mine ore broken by cutting out was 51,030 tons, and the total run-of-mine ore broken by stoping was 78,478 tons. During the months of May and June the rock obtained in stoping No. 401 stope was sorted, yielding 5,059 tons of sorted ore and 14,690 tons of waste. This latter was stored in the stope and was classified as run-of-mine ore after sorting stopped.

The work laid out for completion by Sept. 1, 1916, with the percentage now completed is shown in the following table:

Work	Total Estimated Footage To Be Driven by Sept. 1, 1916. Estimate Corrected Dec. 31, 1915	Footage Driven Up to Dec. 31, 1915	Percentage Completed Dec. 31, 1915
Main raise No. 2.....	1,225	471	34.45
Intermediate drifts	2,676	2,176	81.31
No. 4 level drifts.....	2,390	1,966	82.25
Bulldozing chambers ..	390	68	17.44
Chute raises	1,750	1,406	80.34
Manway raises	275	186	67.63
Stope raises	3,300	2,105	63.79
No. 3 level drifts.....	1,930	250	12.95
Powder drifts	8,000	281	3.51
Total of all development	21,936	8,909	40.61
Cutting out	100,000 tons	23,600 tons	23.60%

It is estimated that 76,400 tons yet remain to be cut out before completion.

During the first five months of the year all ore was sorted in the stopes, it being found that the resulting slate was sufficient in amount to keep the floor of the stope within good working distance from the roof. From Jan. 1 to June 1, 52,205 tons of rock was broken in the stopes and from this there was sorted out 16,657 tons of ore, having an average assay value of $3.2184 per ton. The duty of a machine drill in stoping was 50.2 tons per shift, from which was sorted 32% of quartz and fines. In cutting out, the duty of a machine drill was 19.7 tons per shift, from which was sorted 32%.

During the year 1,329 samples from development returned an average assay value of $1.04 per ton. Those taken exclusively from the Aurora orebody on the No. 2 level averaged $2.09 per ton. The samples taken exclusively from within the limits of the North orebody on the No. 4 level averaged $1.01 per ton. All development work within the area of both the Aurora and the North orebodies is sampled whether in waste or in ore and is included in the averages given.

During the year the stock of broken rock in the mine was increased by 60,115 tons ore and 36,937 tons waste. During the year a total of 16,775 ft. of development work was done.

Operation of and Results at Mill

Since Feb. 21, the date the last 10 stamps were installed, the entire 50-stamp mill has been in operation. The running time for the entire year was 318 days. While crushing through ¼-in. screen, the duty ranged from 11.2 tons to 19.7 tons per stamp day, with an average of 14.45 tons; crushing through No. 8-mesh screen, the duty ranged from 7.68 tons to 9.76 tons per day, with an average of 8.88 tons; and crushing through 24-mesh screen, the duty ranged from 5.03 tons to 6.68 tons per stamp day, with an average of 5.77 tons.

The capacity of the entire mill for the actual running time averaged 565.09 tons per day. This does not represent the ultimate capacity of the mill, however, since at no time has the entire mill crushed through ¼-in. screen with the Chilean mills used in their entirety as regrinding machines. In that case the mill would, no

doubt, have had a capacity of at least 18 tons per stamp day, or 900 tons per day.

Bullion produced by amalgamation from all sources during the year is shown in the following table:

Source	Gold	Silver
Direct amalgamation	$124,645.51	$623.64
Galena concentrate retreatment	6,457.35	32.65
Iron concentrate retreatment	632.60	3.54
Total, 1915	$131,735.46	$659.83
Total, 1914	55,386.04	339.17
Total to date	$187,121.50	$999.00

There was an abundance of labor available throughout the year, the average number of men employed being 301, and the average wage paid, $3.52 per day.

TOTAL ASSAY VALUE OF ROCK MILLED TO DATE

	Tons Milled	Free Gold Recovery	Recovery in Galena Concentrates	Recovery in Iron Concentrates	Middling Value	Overflow Value	Tailing Value	Rejected Waste	Total Value
1914..	60,026	$0.9104	$0.1355	$0.1140	....	....	$0.2700	$0.0027	$1.4326
1915..	179,892	.6929	.3948	.0920	$0.0035	$0.0128	.2827	.0010	1.4797
To date	239,918	.7446	.3270	.0950	.0027	.0096	.2681	.0013	1.4483

Frank G. Janney

The death of Frank G. Janney, May 12, at his home in Los Angeles, following an operation for appendicitis, was the cause of the deepest regret and sorrow to his many friends, and especially to his business associates.

Mr. Janney was born at Salt Lake City, Oct. 12, 1866, and was educated in the public schools there. In 1879 he entered the employ of Nicholas Treweek at the Lowell mine in Park City, Utah. In 1882 he went to Walkerville, Mont., where he was hoisting engineer at the Alice mine. He obtained his first milling experience at the Old Lead Mine mill in Bingham Cañon, Utah, and afterward became superintendent of the mill. In 1890 he was associated with R. M. Jones in the electrification of the Salt Lake City street-railway system and afterward became superintendent of motive power of the Rapid Transit street-railway system of Salt Lake City. About 1893 he went to Toledo, Ohio, as chief electrician of the Toledo street-car system.

He returned to Utah to enter the employ of the L. C. Trent Co. as consulting engineer and traveled extensively for them, erecting milling plants at various points in the West, including De Lamar, Idaho; Jerome, Ariz.; and Needles, Calif. In 1896 D. C. Jackling, at that time superintendent of the Consolidated Mercur Gold Mines, gave him the position of general foreman. When Mr. Jackling severed his connection with this company, Janney succeeded him as mill superintendent. In 1901 he went to Delamar, Nev., as mill superintendent of the Delamar Gold Mines Co. and superintended the erection of the mills, remaining there until the incorporation of the Utah Copper Co. in 1903, when he again became associated with Jackling, and assumed the position of mill superintendent. The successful completion and operation and the remarkable showing of the Utah Copper Co.'s mill are due largely to his genius and great mechanical ability. At the time of his death he not only occupied the position of manager of mills for the Utah Copper Co., but also of the Chino Copper Co., Ray Consolidated Copper Co. and Butte & Superior Copper Co., as well as that of consulting metallurgical engineer for the Alaska Gold Mining Co. He was a thirty-second degree Mason and a member of El Kalah Shrine, of Salt Lake City. He was a member of the Alta Club and the Country Club, of Salt Lake City, and of the California Club and Midwick Country Club, of Los Angeles. He is survived by a mother, a widow, nine children and six grandchildren.

New Jersey Zinc Co.

For the first time since its organization in 1880, the New Jersey Zinc Co. has made public a financial statement covering the first quarter of 1916 as follows:

Net profits		$8,561,385
Deduct:		
Bond interest	$40,000	
Res. retire bonds	75,000	115,000
Surplus for quarter		8,446,385
Dividends paid		6,650,000
Balance net		1,796,385

The net profit of $8,561,385 was after all expenses including depreciation had been deducted. How much was charged off to this or the cost of operations does not appear.

Accompanying the figures was this statement signed by H. S. Wardner, treasuer: "Stockholders should realize that these unusually large profits are due to abnormal trade conditions and must not be regarded as an index of normal earnings."

A. S. & R. Refining Capacity

The copper-refining capacity of the American Smelting and Refining Co.'s plants is approaching 1,000,000,000 lb. per annum. All three refineries have extended their capacities, but at Baltimore more comprehensive enlargements are in progress, which should be completed by the end of summer. The maximum capacity for these plants will then be as follows: Baltimore Copper Smelting and Rolling Co., 588,000,000 lb. per annum; American Smelting and Refining Co.'s Perth Amboy plant, 312,000,000 lb.; Tacoma Smelting Co., 180,000,000 lb. The capacities given are of course for maximum output under high-price conditions, and it is hardly expected that the normal output will reach these figures. The nominal capacity of these plants at the beginning of 1916 was: Baltimore, 354,000,000; Perth Amboy, 240,000,000; Tacoma, 120,000,000 lb.

Copper Movement in March

The Bureau of Foreign and Domestic Commerce, at Washington, announces the imports and exports of copper during March, 1916, as shown in the accompany table:

COPPER TRADE IN MARCH, 1916

	Gross Tons	Contents, Pounds
Imports:		
Ore	41,229	9,268,235
Concentrates	10,389	2,294,400
Matte and regulus	3,882	3,243,975
Unrefined, etc., in bars, pigs, etc., lb.	25,717,307	.....
Refined in bars, plates, etc.	.....	583,165
Old, etc., for remanufacture	.....	1,064,820
Composition metal, copper chief value	.....	66,935
Copper manufactures, n. e. s.	.....	.....
Exports—Domestic:		
Ore	8,754	373,891
Concentrates	310	51,000
Matte and regulus	.....	.....
Unrefined, etc., in bars, pigs, etc.	.....	358,811
Refined ingots, bars, etc.	.....	59,916,932
Old and scrap	.....	3,398
Plates and sheets	.....	2,741,124
Wire	.....	1,971,346
All other manufactures	.....	.....

How Flotation Works

The formulas noted in Fig. 1 of the article on "How Flotation Works," in the *Journal* of May 13, 1916, are transposed. Correctly stated, the formula for the sphere is $P = \frac{2T}{R}$, and that for the cylinder, $P = \frac{T}{R}$.

Editorials

The Prices for the Metals

Some of the metals that soared to phenomenal prices have fallen from their high estate and are going to fall farther. That is a safe prophecy when no specification as to time is attached to it. It is obviously a matter of time only, for extraordinarily profitable prices are bound to stimulate production to an extent that sooner or later will reduce things to a normal basis.

The most spectacular decline has been in quicksilver. This metal which ordinarily is worth $40@45 per flask, rose to about $300, but is now down to about $90 in a market that looks none too good. The advance was initially well-founded, but when it had already gone far, the sellers undertook to boost it artificially and let their greed run away with their good sense. The Du Pont powder company represented the situation to the British government, which released a sufficient supply to relieve the large consumers making explosives on military contracts, and the bottom promptly dropped out of the American corner.

Antimony is another drooping war-bride. From a price of about 45c. per lb. there has lately been a decline to about 31c. Tungsten ore has fallen from about $85 per unit to about $45. In both of these cases increasing production is also the explanation.

The same thing has been looked for in spelter during the last nine months. The production has been steadily increasing in a remarkable way, but the experts have been deceived right along by the unforeseen proportions of the demand from the brass-makers. "Wolf!" has been cried so often when no wolf appeared that most people have lately been lulled into the comfortable feeling that there is no wolf.

For about a year the spelter market has been conducted without the balance wheel of an unsold stock. The price has declined several times on the selling by interests that thought they saw the end of the boom and rallied smartly when they found they had been mistaken. We have learned to look for several signs indicating the permanent decline. Among these will be the contraction of the premium for high-grade, intermediate and brass spelters, then the reselling by consumers who find themselves overbought, and finally the accumulation of unsold stocks in the hands of producers. The latter have made so much money during the last year that they will not be forced to sell in order to get cash to carry on their business. Therefore there should be no urgency about their selling at first and no demoralizing pressure until they are confronted with the choice of making up their minds whether they would rather have money or spelter.

During the last fortnight the spelter market has been quietly declining. There appear to be some of the signs that have been anticipated, not as yet very strong, but nevertheless indicative. The next six weeks, taking us up to the mid-year, is likely to produce interesting developments in the spelter market.

Turning to the other metals, copper is still very strong, supplies being scarce with no signs of immediate increase, but here also the expanding production must tell in the long run. Lead also is strong, but not so strong as copper. Ten days ago this market was wabbly, but rallied on some more large export sales being made. The behavior of this market indicates that it is about at its zenith.

Silver had a belated rise and is perhaps the freshest of the metals in that respect. Having gone up about 50% since the beginning of the year, the cream of the advance has probably been skimmed, but there appears to be a well-informed confidence that it may go even higher than at present.

The Scarcity of Ships

The scarcity of ships and the consequent great increase in ocean-freight rates is checking our foreign commerce in a very serious way, especially inasmuch as it is becoming impossible in many cases to get freight room for love or money. Adventurers and traders are building new ships as fast as they can turn them out. They are rapidly restoring the American merchant marine. At the end of 1915 the merchant marine of the United States, including all kinds of shipping, was made up of 26,701 vessels of 8,389,429 gross tons, which was an increase in the year of more than 460,700 gross tons. This fleet, which is second only to the merchant marine of Great Britain (with a total of 20,874,309 tons) was composed of 6,952 steam vessels of 5,781,416 gross tons, 5,866 sailing vessels of 1,384,474 gross tons, 4,327 barges with a gross tonnage of 999,166; 8,996 documented motor vessels of 162,394 gross tons and more than 500 documented canal boats of an approximate tonnage of 61,900 gross. There were under contract on Mar. 31, 1916, in American shipyards 31 vessels of between 8,000 and 12,000 gross tons, as compared with 26 in British yards. In American yards there were 77 vessels under contract of between 5,000 and 8,000 gross tons, against 88 of the same size in British yards.

But this expansion of American shipping, however pleasing, is far from being enough. We have succeeded in impressing our manufacturers with the importance of trying to get as much as possible of South America's 1,200 million dollar yearly imports, as this will mean a 50% increase in our exports if we get all of it. In spite of all that has been done so successfully thus far, we are about to lose much of our new trade there unless something is done immediately to relieve the situation.

Prior to the war freight rates to Buenos Aires were about $4 a ton. The average purchase price of a freight steamer is about $50 per ton. Recent rates have actually reached $40 to $50, according to commodity, and this was paid because it was absolutely necessary. So that freight rates for a single 30-day trip are now greater than the purchase price of the steamers before the war.

If we fail to ship now, when we are having our opportunity, South America will be compelled to manufacture at home a good deal of what they now buy from us, and that market will be lost.

The situation is one that calls for earnest thought and prompt action. It is distressing to look across the Hudson River and see the great tonnage of German ships tied up there, idle. Cannot the Department of State negotiate some plan whereby American shipping companies might purchase or lease them? Cannot Congress immediately give it a free hand to put them under the American flag if a trade could be arranged?

The Labor Situation

The most embarrassing thing in the present industrial situation is the unreasonable and ever-increasing demands of labor. The corporations, especially the mining and manufacturing companies, have made great profits, some of them a great deal more than others for special reasons. All of them have been generous in sharing profits with their workmen, wages having been raised repeatedly and voluntarily. But labor is scarce and uneasy. Its market value has appreciated. The employer is daily confronted by new demands. Resistance is followed promptly by a strike. In the mining and metallurgical industry the latest have been strikes by the lead miners in southeastern Missouri and by the zinc smelters in Oklahoma. Neither in lead mining nor in zinc smelting may any strong resistance be offered. In some of the less profitable industries, however, the maximum limit has been reached and works have been shut down where new demands exceeded what remained to give. We shall see more of that before we are done with the present industrial movement.

The behavior of labor is perfectly natural. The supply is relatively scarce. It is a bull market for labor. If the employer will not pay the market price, his men will go elsewhere if they belong to the more mobile classes. If to the less mobile, they will be uneasy and, recognizing perhaps that their employers cannot pay any more under existing conditions, as in the case of the railway companies, will inspire them to raise rates (with the permission of the authorities, if necessary) and make the public pay.

The most alarming thing about the situation is the demoralization among artisans, mechanics and laboring men generally that is produced by the extravagantly high wages of the day. The aristocratic lead burner, getting $10 per day, time and a half for overtime and a bonus for finishing his job by a specified date, prefers to linger in the lobby of the hotel and to ride around in his Ford car to working 10 hours a day and six days in the week. The shoveler in the mine, who used to clean up 25 tons of ore per day, wants a higher wage with a limit of 20 tons. The smelter is careless about his work and when his boss remonstrates, exhibits his independence by quitting and accepting a position in a neighboring plant where they are not so particular about metallurgical efficiency.

Alas! that the tenets of the labor leaders do not include principles of economy, efficiency, and profit-sharing! As to the last, a recent report by the welfare department of the National Civic Federation gives us rather a gloomy view.

Civic workers have been engaged for 12 months in investigating more than 300 so-called profit-sharing schemes, and their report covers the analysis of about 200 plans. The report comes to no conclusion for or against the profit-sharing idea, but it devotes more than 260 pages to an exposition of the many plans in force today, or tried and abandoned, and sets forth a group of interesting opinions and discussions, both from prominent employers, representatives of organized labor, and from special students of the subject. The views of the leaders of organized labor appear unanimous in opposition to the general theory and practice of profit sharing, while a large number of the employers whose plans are analyzed in the report, consider profit sharing a success.

"Many reasons," says the report, "are given by these employers for their faith in the idea. Among these are that it promotes more continuous service, reduces cost of production, secures more regular attendance at work, builds up confidence and creates a spirit of coöperation, gets rid of rolling stones and encourages home building, enables the company to keep its employees during rush seasons, induces salesmen and others to work harder, promotes efficiency, interest and loyalty, and increases the profits of the business."

"Yet," the report continues, "employers who have had experience on the subject are by no means a unit as to its practical value. Some express disappointment that the efforts of their companies were not appreciated by the men, that they seemed to prefer their total earnings in fixed wages, with no variable element, that they were suspicious of the employers' motives, that they insisted upon joining unions and presenting demands in spite of the companies' efforts to give them an extra share of the business, that when stock was sold to employees upon favorable terms they would dispose of it at a profit when its value rose and so get the habit of watching the stock market, that when the profit distribution was large the employees learned to expect a similar 'bonanza' every year, and were disgruntled if they did not get it."

Yet we have a satisfactory and apparently successful system of profit sharing in our copper-mining industry, where wages have been adjusted on a sliding scale according to the price for copper. Among the copper mines there seems to be far less demoralization of labor than in any other branch of our industry at present, except among those lead mines where a similar system has been adopted. This system is well worthy of study and further extension, but it is possible of course only in cases where the whole industry is based on the market for a single, staple commodity. It could hardly be applied to the fixing of the rate of wages in a woolen mill.

Villa remains uncaught, and the situation as to Mexico appears now to be a more or less futile effort to keep Mexican bandits from raiding into American territory. The logic of events is clearly that the United States will have to go into Mexico to put things in order, and will have to raise and equip forces sufficient to do it. The present administration may continue to hesitate about this, but sooner or later it will have to be done, and will be done. The demoralization in Mexico is deeper and more terrible than most people in this country understand. The country is bankrupt, its inhabitants are without means to obtain adequate food and clothing. Carranza is but a figure head. Banditry prevails.

BY THE WAY

The A-B-C of Safety is A-lways-B-e-C-areful.

The combined statement of Joplin banks, just compiled, shows, according to the *Boston News Bureau,* deposits of almost $10,000,000—an increase of 118% over a year ago, testifying to zinc producers' prosperity.

The star bonehead play is described in a recent number of the American Smelting and Refining Co.'s *Safety Review:* Solid Ivoryski, of Cokedale, was putting water into his carbide lamp by first filling his mouth with water, then squirting it into the lamp. As he put his lips to the lamp it suddenly flamed out, burning his lips.

In a recent number of the esteemed *Saturday Evening Post* we note the mention of a "merchant prince, who had grown rich extracting phosphate of aluminum from the rocks west of the town" (Port St. Vincent, on the Caribbean Sea). Maybe so; we would give two kopecks to know the process and to what use the material was put.

A soap bubble blown by Sir James Dewar at the Royal Institution on Feb. 17 did not burst until Mar. 24 (assisted by Zeppelin ?), which is given by the London papers as a record life for a bubble. We don't know about this. We have seen some mining promotions lasting a little longer than that, and we bet Dewar's bubble didn't go any more completely than they eventually did.

A broker received a request from a small customer to get an offer of 100 shares of Union Sulphur, says the *Annalist,* of New York. When the report came in the customer began to laugh before the broker brought over the slip. The stock was offered at $12,000 a share. The bid might have been an important part of the record, but that was missing from the slip.

"A three-foot gold vein was discovered at a boiling spring," says the Ellijay (Ga.) *Times-Courier,* "gushing up almost in a spout and bringing up particles of gold; and upon investigating the spring, digging and panning out the particles of gold, the lode was stripped naked and found to carry free gold." Don't see why they didn't let it keep on spouting gold; panning is such a back-breaking job.

Bulletin boards at mines collect a choice lot of simplified spelling and occasional bits of operating humor. *Teniente Topics,* the clever magazine edited by the staff of the Braden Copper Co., reproduces the following entry on the night-shift logbook of the nodulizing plant at Sewell, Chile: "Ring in Kiln very hard, the stoff waht is sticken to the linnen is nothin but Slim, tried to nudelys et but no use had to runner out. I leavt one of dem nippels on the tabel if the burner aint in use it shoot be took out or she burns up dat is therisen we are usen so many dem nippels."

The high polish of Russian shells has been the subject of much discussion. One reason suggested when the shells were silver- or nickel-plated was that the plating acted as a resister against rust. And one of our rather sarcastic friends thought that so finished, the shells looked better as souvenirs on the top of a grand piano in a drawing room. The subject may now be settled and further discussion cease. We have it from a high Russian authority, says the *American Machinist* that the fine finish and polish are to prevent pulling off some lint from the cotton gloves worn by the soldiers who load the guns. A rough surface on the shells would pull off some of this lint, which would fill up the clearance between the shell and the gun bore and impair the accuracy of the firing.

An advocate of scientific management told the following tale the other day, says *Engineering and Contracting.* Two men stood watching a steam shovel at work. With a clatter and a roar the shovel bit into the steep bank, closed on a cartload of earth and dumped it on a waiting car. "It makes me wild," said the first onlooker, "to see that monster taking the bread out of good men's mouths. Look at it. Why, it's filling up those cars faster than a hundred men with picks and shovels could do it." But the other onlooker shook his head and answered: "See here, mister, if it would be better to employ 100 men with picks and shovels on this job, wouldn't it be better still to employ 1,000 men with forks and tablespoons?"

The champion dividend payer among the mining and metallurgical companies is without any doubt the New Jersey Zinc Co., which has just declared its regular quarterly dividend of 4% on its capital stock of $35,000,000 and an extra dividend of 5%. This company makes three commodities that have participated in the phenomenal rise of prices during the last year, namely, spelter (high grade), spiegeleisen and sulphuric acid. The principal stockholders of the New Jersey Zinc Co. are enumerated by the *Boston News Bureau* as follows: August Heckscher, 32,214 shares; other members of the Heckscher family, 5,592; Edgar Palmer, 30,124; Ralper Palmer, 7,087; David B. Jones, 17,976; T. D. Jones, 18,049; J. L. Riker, 10,941; J. P. Wetherill, 17,500; S. P. Wetherill, 12,586; Hetty Green, 3,500; W. F. Hardenburgh, 7,364; J. E. Hayes, Jr., 10,762; W. O. Morse, 10,500.

Technical literature is, like life, becoming more complex as we grow older—or else we are getting into our dotage and are less quick of comprehension. At any rate we invite attention to the following: "Every chemist in general will agree that up to the present our methods of gravimetric, and volumetric analysis are apt to have some phase where the accuracy is in doubt, where the reaction is not fully, or in some cases purely hypothetical, and therefore not absolutely correct; we therefore go through journals and chemical literature to find our way out of a labyrinth of reactions which take place by a simple precipitation of two bodies chemically acted upon according to the laws which govern these reactions, visible and obscure, to all our scientific endeavors, methods, instruments, ability and chemically reasoning." We are this minute groping out of said labyrinth.

They were sinking a shaft, says *Engineering and Contracting,* and had got down about 100 ft. One of the workmen fell in but lodged about a third of the way down

and his fellow laborers struggled to save him. Just as they thought they had succeeded, Pat crashed down another 25 ft., when another obstruction caught him and the rescue campaign was begun anew and with greater difficulty. When they were a second time on the point of success, to the dismay of the rescuers, Pat went headlong into the lower depth. All was silent, no sound coming from the unfortunate Irishman. The foreman leaned over the edge of the shaft and shouted: "Pat, I say, Pat." From the depth came the answer: "Hurroo." "Are you much hurt, Pat?" "I am not." "Where are you, Pat?" "What's that ye're sayin'?" "Where are ye?" "Where am I? Where am I? Glory be to heaven, I am on the bottom at lasht."

A picture of a bunch of tennis players in a mining company's annual report would not ordinarily be considered *comme il faut*. However, the annual report for 1915 of the Hollinger Gold Mines Co., Ltd., Ontario, Canada, contains two unusual features which in this case give a gripping personal touch to the report that could not possibly be done by anything less vital than in this instance. The report states:

More important than our operations of mining and milling has been the response on the part of the members of the company's organization to the call for men to serve at the front. It is with mixed feelings of pride and regret that I submit the following list of men who have left us to go upon active service. Of these, Charles E. Barnett and Arthur H. McKay will not return; they lie buried "somewhere in France." Let us hope that there will be no further loss of life to record among our representatives at the front.

Following this is a list of the men who are with the British, French and Italian armies, giving their former position at the mine, their present rank and organization in the service. There are 94 names on the list, including men in every department from chore-boy to geologist. The average number of men employed during the year was 735, so that the company's contribution of men is a strikingly large one. On another page of the report is a large halftone of a group of tennis players "from a chance snapshot taken on the Canadian Mining and Finance Co.'s tennis courts, shortly before the outbreak of the European War." This group shows eight tennis players, all of whom are in the service at the front, including the two who died on the field of honor. There is apparently no place for slackers with the Hollinger, and the company has done the handsome thing by its soldier employees.

Selling lots in a "sulphur subdivision" is the latest form of real estate-mining speculation that is being offered simultaneously to farmers and other small investors in Illinois and the East, and possibly in other parts of the country. This particular form of speculation is offered as the "Standard Sulphur Co.'s land subdivision, situated in the famous sulphur and oil fields at Sulphur, La., near the Union Sulphur Co." Land that does not contain sulphur or oil in this part of Louisiana is worth only about $20 an acre. The Standard Sulphur Co., Inc., however, proposes to sell the small investors lots of 300-sq.ft. area for $30. A brief calculation will show that there will be 145 of these lots per acre, and at $30 a lot they would bring the modest price of $4,350 per acre, or a total of $348,000 for the 80 acres which it is proposed to subdivide. By citing the great success of the Union Sulphur Co. in that vicinity, the Standard Sulphur Co. endeavors to make it appear that these are low prices and easy terms. It will be remembered, however, that Herman Frasch drilled a well about a mile from the Union Sulphur Co.'s dome and found only limestone. The promoters endeavor to figure what will be the value of each lot they are offering—if they strike sulphur. Their method of doing this is to take a mathematical excursion as follows: "Suppose the land is underlaid with a deposit of pure sulphur 120 ft. thick. A calculation will show that in 80 acres there would be more than 418,000,000 cu.ft. of sulphur; estimating each cubic foot to weigh 125 lb. we would have 26,136,000 tons of sulphur, valued at more than $522,000,000. This would mean a value to lot holders of the enormous amount of ——." It would be easier to swallow these figures and take a chance with the promoters if they were more careful about their statements or misstatements of known facts. For example, one paragraph of the prospectus leads off with the statement "according to reliable authorities, an average of 600,000 tons of sulphur is annually being taken from the holdings of the Union Sulphur Co. near ours." Prospective investors may discover from the files of the *Journal* and other reliable sources that these figures are exaggerated, and also that the consumption of sulphur in the United States is not much over 300,000 tons per annum. A company operating a similar "real estate-mining speculation," in the southeast corner of the same section as the Standard's land subdivision, drilled a hole about 4,150 ft., but struck neither sulphur nor oil.

J. Parke Channing is one of the bulwarks of the art of aviation in the United States and is distinguished in the Aero Club of America, whereof he is one of the charter members. He is not personally an aviator, but he has made more than one ascent. As a life member of the Aero Club he recently signalized the importance of the organization by presenting to each of the 28 life members a membership card of solid gold, stamped with the seal of the club and mounted on a folder of lizard skin.

UNIQUE LIFE MEMBERSHIP CARD OF AERO CLUB

NEW PUBLICATIONS

RIVISTA DEL SERVIZIO MINERARIO NEL 1914. Pp. 404. Ministero di Agricoltura, Industria e Commercio, Bergamo, Italy.

TEXADA ISLAND, B. C. By R. G. McConnell. Pp. 112, illus. Memoir 58, Canada Department of Mines, Geological Survey Branch, Ottawa.

THE DATA OF GEOCHEMISTRY. Third Edition. By Frank Wigglesworth Clarke. Pp. 821, Bull. 616. U. S. Geological Survey, Washington.

LABOR LAWS OF CALIFORNIA. Compiled by John P. McLaughlin, Commissioner. 4½x6½, pp. 252, paper. Bureau of Labor Statistics, San Francisco, Calif.

UPPER WHITE RIVER DISTRICT, YUKON. By D. D. Cairnes. Pp. 191, illus. Memoir 50; Canadian Department of Mines, Geological Survey Branch, Ottawa.

NOVA SCOTIA: ANNUAL REPORT OF THE MINES, 1915. By Hiram Donkin, Inspector of Mines. Pp. 181, illus. Department of Public Works and Mines, Halifax, N. S., Canada.

FIELD ANALYSIS OF MINERALS. For the Prospector, Mining Engineer, Traveler and Student. By G. D. McGrigor. 4½x7, pp. 88; 3s. 6d. The Mining Magazine, London, E. C.

FOURTEENTH REPORT OF THE GEOGRAPHIC BOARD OF CANADA CONTAINING ALL DECISIONS TO MAR. 31, 1915. Pp. 273. Department of the Interior, Ottawa, Ont., Canada.

GEOLOGY OF CRANBROOK MAP-AREA, BRITISH COLUMBIA. By Stuart J. Schofield, Pp. 245, illus. Memoir 76, Canada Department of Mines, Geological Survey Branch, Ottawa.

DESCRIPTION OF THE LABORATORIES OF THE MINES BRANCH OF THE DEPARTMENT OF MINES, OTTAWA. Pp. 51, 60 plates. Bull. 13, Canadian Department of Mines, Mines Branch, Ottawa.

THIRD REPORT TO THE CORROSION COMMITTEE OF THE INSTITUTE OF METALS. By William E. Gibbs, Richard H. Smith, and Guy D. Bengough. Pp. 127, illus. Institute of Metals, London, England.

UEBER DIE AUSFAELLUNG DES EISENOXYDS UND DER TONERDE IN FINNLAENDISCHEN SAND- UND GRUSBOEDEN. By B. Aarnio. Pp. 76, illus. Geologiska Kommissionen. Helsingfors, Finland.

THE UNDERGROUND AND SURFACE WATER SUPPLIES OF WISCONSIN. By Samuel Weidman and Alfred R. Schultz. 6½x9½, 664 pp., illus. Bull. XXXV, Wisconsin Geological and Natural History Survey, Madison.

THE QUARRY MATERIALS OF NEW YORK—GRANITE, GNEISS, TRAP AND MARBLE. By D. H. Newland. Pp. 212, illus. New York State Museum Bull. No. 181, Jan. 1, 1916. University of the State of New York, Albany, N. Y.

A WATER-POWER RECONNAISSANCE IN SOUTH-CENTRAL ALASKA. By C. E. Ellsworth and R. W. Davenport; with a section on Southeastern Alaska, by J. C. Hoyt. Pp. 173, illus. Water-Supply Paper 372, U. S. Geological Survey, Washington.

SOUTH AUSTRALIA: ANNUAL REPORT OF THE GOVERNMENT GEOLOGIST. Including Appendix Comprising a Catalog of Official Publications Dealing with the Geology and Mineral Resources of South Australia. Pp. 22, illus. L. Keith Ward, Adelaide.

MINERAL LAND CLASSIFICATION. Showing Indications of Iron Formation in Parts of Ashland, Bayfield, Washburn, Sawyer, Price, Oneida, Forest, Rusk, Barron and Chippewa Counties. By W. O. Hotchkiss, assisted by E. F. Bean and O. W. Wheelwright. 6½x9½, pp. 367, illus. Wisconsin Geological and Natural History Survey, Madison.

MANUFACTURE OF GASOLINE AND BENZENE-TOLUENE FROM PETROLEUM AND OTHER HYDROCARBONS. By W. F. Rittman, C. B. Dutton and E. W. Dean, with Bibliography Compiled by M. S. Howard. Pp. 268, illus. Bull. 114, U. S. Bureau of Mines, Washington.

Contains an interesting résumé of the cracking processes in use described in non-technical and unusually readable form, followed by detailed technical description of processes and apparatus.

KOWKASH GOLD AREA. By P. E. Hopkins. 6½x10, pp. 15. Illustrated, with maps. Bulletin No. 27, Ontario Bureau of Mines, Toronto.

Embodies the result of a preliminary investigation made last September, following the discovery of gold, and a subsequent visit later in the year covering other discoveries. The original gold discovery was made by E. W. King Dodds. The Kowkash area presents pre-Cambrian rocks similar to those found elsewhere in northern Ontario.

ABSTRACTS OF CURRENT DECISIONS ON MINES AND MINING, Reported from May to September, 1915. By J. W. Thompson. Pp. 124. Bull. 113, U. S. Bureau of Mines, Washington.

This bulletin is the fifth of its kind to be published by the Bureau of Mines, the four preceding being Bulletins 61, 79, 90 and 101. The wide demand for the information contained in these bulletins has led the bureau to decide to issue similar ones with sufficient frequency to keep reasonably current the records of decisions of Federal and state courts of last resort on questions relating to the mineral industry.

THE LURE OF CRIPPLE CREEK GOLD. By William Y. Seaman. 4¾x6½, pp. 48, illus., paper; 15c. William Y. Seaman, 1842 Stout St., Denver, Colo.

This little pamphlet contains a very interesting description of the discovery, development and history of the Cripple Creek District, gives a few figures of total production and many interesting anecdotes of the men and the days which made the camp so famous.

ELEVATORS. A Practical Treatise on the Development and Design of Hand, Belt, Steam, Hydraulic and Electric Elevators. By John H. Jallings. 5¼x8¼, pp. 217, illus. American Technical Society Chicago, Ill.

A practical book by a practical man, of interest to the mining man only regarding the application of the elevator principle to man-hoists. In this connection the book has some interesting diagrams of the wiring systems of electrically controlled, multi-speed, automatic cars for various numbers of floors or stopping points.

THE DIESEL ENGINE IN PRACTICE. By J. E. Megson and H. S. Jones. 4½x6¼, pp. 136, illus., leather; $2. Technical Publishing Co., San Francisco, Calif.

This little book has been prepared for the purpose of giving to engineers who are running or interested in Diesel engines the benefit of many years of practical experience in operating them, by one of the authors. He believes "that not 10% of the operators of Diesel engines know one-quarter as much about their engines as the average steam engineer knows about his engine."

The book deals briefly with the history of the invention, the reasons why the introduction of the engine has made such strides abroad and so little progress in this country, and follows with an interesting and well-illustrated chapter describing the operation of the engine. The experiences with earlier installations, including a series of acceptance tests, fuel oil and the effect of altitude, are taken up, and a chapter is devoted to the operation and care of the engine. There are 20 or more manufacturers building different types of Diesel and semi-Diesel engines in this country, several of them adopting foreign designs. Some of these types are described. Under the caption "Commercial Situation" a comparison of the costs of installation and operation of Diesel and steam plants is made, and a chapter is devoted at the end of the book to the Diesel applied to marine purposes.

THE METALLOGRAPHY OF STEEL AND CAST IRON. By Henry Marion Howe, Professor Emeritus of Metallurgy, Columbia University. Quarto, pp. 641, profusely illustrated; with 45 plates of micrographs; $10. McGraw-Hill Book Co., New York.

Here is a rich mine of information for all persons, whether users or manufacturers, who are interested in the quality of steel and cast iron. In includes everything related to the subject of quality, from manufacture to slip bands, characteristics of fractures, micro-constitution and the application of the phase rule. The book touches but briefly on the manipulative side of metallography, such as methods of testing, etching mediums and apparatus for microscopic examination, which is already well covered in other text and reference books, but delves deeply into the philosophy and theoretical phase of the metallography.

The method of exposition is the same as that followed in recent years by the same distinguished author—namely, of presenting all the important evidence extant, together with a minute and masterly analysis of the facts adduced. In this analysis the author shows that extraordinary ingenuity in making a difficult subject clear and that mental grasp of complex subjects which he possesses to so marvelous a degree.

Among the principal subjects discussed are manufacture, nomenclature, constitution (including micro-constitution), thermal and physical transformations, formation of graphite, the application of the phase rule, the structure of metals, deformation under strain, including slip bands, silhouettes, twins, X-bands, ghosts and fiber, with related subjects such as rupture and fracture.

The direct and practical usefulness of the book was not a predominant idea in the author's mind, as explained in the preface, but we prophesy that it will be of inestimable benefit to all those who desire to secure a real mastery of the underlying principles governing the qualities of the metal discussed, and that it will be a reference book a great many years hence, when the mind of man has developed more nearly equal to that of the author.

Besides a great number of tables, curves and illustrations, the book contains more than 300 micrographs, which form the largest and finest collection which we know of in any one place.

A most unfortunate weakness in this book is the index, which actually does not occupy as many pages as the table of contents, and which is wholly inadequate for any practical use, especially for a reference book such as this is destined to be.

PERSONALS

Gus Holmes, of Salt Lake City, is in New York.

E. W. Steele, of Tacoma, Wash., is now at Hayden, Ariz.

Paul W. Clark, of Berkeley, Calif., is at Tonopah, Nev.

H. C. Klaus, recently at Berkeley, Calif., is now at Jarbidge, Nev.

E. M. Bagley, recently at Los Gatos, Calif., is now at Oatman, Ariz.

C. L. Constant, Jr., returned to New York on May 11 from a short trip to Cuba.

Russell T. Mason, of Los Angeles, Calif., is now at Harqua Hala, Yuma County, Ariz.

Frank G. Stevens has removed from Halifax, Nova Scotia, to Toronto, Ont., Canada.

B. B. Thayer leaves for Butte on May 14, expecting to be back in New York about June 1.

Myron R. Walker, lately of Tucson, Ariz., is now with the Cerro de Pasco Mining Co. in Peru.

Dale L. Pitt, recently of Park City, Utah, is now with the Tacoma Smelting Co., at Tacoma, Wash.

J. B. Tyrrell arrived in New York, May 11, on his way home from England and proceeded to Toronto.

Charles Geddes for two years connected with the Standard Oil Co. at Shanghai has returned to San Francisco.

R. R. Leslie, manager of Butters Divisadero Co., Salvador, is now in New York and will probably remain for 10 days.

J. R. Finlay is going to deliver the commencement address at the Colorado School of Mines, Golden, Colo., on May 26.

Heath Steele left New York May 10 to make examinations in South Dakota and Arkansas and will be absent until June.

W. R. Ingalls is going to deliver the commencement address at the School of Mining and Metallurgy, Rolla, Mo., on May 26.

A. G. Burrows, of the Ontario Bureau of Mines, has been detailed to complete the geological survey of the Boston Creek gold area.

George B. Dillingham, formerly at the San Vincente mine, has gone to Tepic to take charge of the development of a copper-lead-zinc mine.

Edward Barrett, for 10 years manager of the Jeanesville Iron Works at Hazelton, Penn., has resigned to take up practice as a consulting engineer.

W. E. William, an American oil expert, recently returned to San Francisco from India, where he says the fields are producing oil on a large scale.

Charles J. Harrah, formerly vice-president of Midvale Steel Co., recently spent several weeks in California and visited San Francisco on his return to Philadelphia.

Alden H. Brown has returned to New York after several months in Colombia and will return there after making a trip to Cuba relative to an iron-ore property.

A. L. Graham has been appointed superintendent of the Superior & Boston Mining Co. He was formerly with the Arizona Commercial Co. and at the Old Dominion mine in Arizona.

Frank R. Corwin has resigned his position as shift superintendent at the Copper Queen to become assistant superintendent for the Consolidated Arizona Smelting Co. at Humboldt, Ariz.

W. H. Coverdale and W. W. Colpitts announce that their practice as consulting engineers will hereafter be conducted under the firm name of Coverdale & Colpitts at 66 Broadway, New York.

M. Alan Hill, assistant superintendent of the openhearth department of the National Tube Co. at Lorain, Ohio, has been appointed superintendent of the openhearth plant of the Colorado Fuel and Iron Co. at Pueblo.

Arthur J. Hoskin, of Denver, Colo., will on June 1 resume his partnership with Frank J. McNair and will make his headquarters at Leadville, Colo. The original firm of McNair & Hoskin was dissolved 13 years ago.

Frank M. Estes, formerly resident engineer for the American Smelting and Refining Co., Sonora, Mexico, is now in charge of the office of the same company, which was recently established at Spokane, Wash.

G. C. Bateman, formerly connected with the Canadian Mining and Exploration Co., has been appointed general manager of La Rose Consolidated, in place of R. B. Watson who has resigned to look after his private interests.

Sidney A. Reeve has opened an office at 120 Broadway, New York, as consulting engineer, specializing in tests, patents, and litigation. He was at one time professor of mechanical engineering at Worcester Polytechnic Institute.

F. L. Lowell, deputy mine inspector, is making an extended inspection of mines along the Mother Lode in Amador County, Calif. John W. Gebb, deputy mine inspector, is engaged in similar work in the Grass Valley and Nevada City districts.

R. T. Bayliss, the well-known chairman of the Exploration company, who met with a serious accident from a Zeppelin bomb on Apr. 26, as noted last week, was in his own house at Newmarket at the time, standing by a window and was struck by a fragment of a bomb exploding outside.

A. J. McQuatters, president, Alvarado Mining and Milling Co., Parral, whose property has been raided a time or two lately, and who has participated in three other conferences, was present at the conference between Generals Scott and Obregon at El Paso, Tex., May 9, but withdrew on complaint of the Mexican representatives that his business connections rendered his presence undesirable.

H. C. Perkins and Hennen Jennings are to sail from Seattle for Alaska June 20, to look over the physical condition of the Treadwell mines. Mr. Perkins and Mr. Jennings, together with F. W. Bradley, constitute a committee of three to agree on the basis of the proposed amalgamation of these mines, which agreement will in turn have to be ratified by a majority of the stockholders of each company.

OBITUARY

John E. Mattson, Ironton, Minn., owner of the fee to the Armour No. 1 mine, died recently, leaving an estate valued at $700,000. He began life as a painter. He was a Scandinavian by birth.

Captain B. F. Chynoweth, well known copper country mining man, died, May 10, at his home in Houghton, Mich. He was born in Pottsville, Penn., 65 years ago, going to the Michigan copper district with his father, the late Captain John Chynoweth, a pioneer of the district. At one time Captain B. F. Chynoweth was the sole owner of the Mass copper mine at Ontonagon, Mich., disposing of his interests there in 1898. He was interested in a number of copper properties in the West. Interment was in Houghton.

Lucien I. Blake, a well-known electrical engineer, died at the Boothby Hospital in Boston, Mass., on May 4. Professor Blake was born in Mansfield, Mass., in 1854, and was graduated from Amherst College in 1878, after which he took the degree of doctor of philosophy in Berlin. He was the inventor of a submarine signal and of an electrostatic ore separator. In making his experiments on the submarine signal he used the United States frigate "Constitution." Professor Blake was a brother of Percy M. Blake, consulting engineer, of Boston.

J. Winchester Holman died suddenly at his residence in Chicago, May 10, of heart disease, aged 45 years. He was born in Indianapolis and when a young man engaged in the advertising business. For some years he represented the "Journal" in Chicago; later in connection with George S. Scott, he acquired control of the "Mining World," removing its office from Butte, Mont., to Chicago. He aided in organizing the Mining World Co. in 1903 and successively held the offices of secretary, treasurer, vice-president and president. He was a member of numerous clubs and societies and was universally popular among his friends and associates. He leaves a widow, two sons and a daughter.

John Edson Sweet died in Syracuse, N. Y., May 8, aged 83 years. He had a long and varied career as a mechanical engineer and designer, and was widely known as the originator of the straight-line, high-speed engine. For some years he was an instructor in Cornell University. He was one of the founders of the American Society of Mechanical Engineers and in fact it was he who first suggested the formation of the Society. He was a member of several other technical societies, and was the first president of the Engine Builders' Association of the United States. In 1913 he was awarded the John Fritz medal for his achievement in machine design and in construction and development of high-speed engines.

Editorial Correspondence

SAN FRANCISCO—May 10

Marigold No. 5 Dredge, completed and started digging on May 6, was built by the Union Iron Works Co., of San Francisco. In the "Journal" of May 6, 1916, an item on p. 808 regarding the launching of this dredge, contained an error in stating that the dredge was built by the Union Construction Co., of San Francisco.

Oil Inspectors To Be Appointed by the State Mining Bureau under civil-service rules, will be examined in San Francisco, Los Angeles and Bakersfield, May 20. There will be four appointments at salaries from $1,500 to $2,100 a year. At the same time examinations will be held for oil-well drillers at salaries ranging from $2,100 to $2,400 a year. The oil department of the State Mining Bureau has made great progress in the investigation of water infiltration and has incidently published a large amount of valuable information for oil operators; and the best of it is that under the law the operators, who are the persons benefitted, are paying for the services. There was a time when a strong effort was made to put the cost of this service to the oil industry upon the whole taxpaying people of California; but finally in the last regular session of the legislature wisdom prevailed and the undertaking was begun in the proper way and is now producing the expected results.

The Dutch-Sweeney-App Mines in Tuolumne County are giving encouraging returns under development by W. J. Loring and Boston men. Mr. Loring recently left for a conference with his Boston associates and on the day of his departure, received information from the mines that in extending the north drive on the 1,650-ft. level in the Sweeney, an oreshoot had been opened for a length of 160 ft. At the 940-ft. point north of the Dutch shaft, at the face of the north drive on the 1,650-ft. level, a crosscut to the east intersected the ore. The operations of Mr. Loring and his Boston associates also include a large acreage of quartz ground in Calaveras County near the Melones mine. The amount of money spent remodeling the Dutch stamp mill and installing two Hardinge mills is sufficient evidence of the faith Mr. Loring has that the properties can be again put in the dividend class. The Dutch and the Sweeney have been kept going for the last two or three years as producing mines but the App was allowed to run down. Mr. Loring's success in association with Albert Burch in the reopening of the Plymouth Consolidated mine in Amador County, has made it possible for him to obtain options on a number of old properties. While the Plymouth Consolidated was developed by money furnished by Bewick, Moreing & Co., the operation of the Dutch-Sweeney-App and the prospecting of other properties in Calaveras County are being financed solely by American money, principally from Boston.

DENVER—May 11

Deep Development in Cripple Creek continues to bring in important strikes of fine ore. The latest cause for belief in the efficacy of deep mining is the discovery of a 6-ft. vein at a depth of 1,900 ft., carrying from 2½ to 6¼ oz. gold per ton.

The Parkdale District, in Fremont County, of which little has been heard for years past, is reviving. Among the old properties being reopened are the Green Mountain, Copper Girl, Copper Jack, Copper Jerry and the Bonrite. As might be inferred from the name, the chief metal produced is copper but there are also small amounts of gold and silver.

Montezuma Is Becoming Active again. In this Summit County camp, which has lain dormant since the 90's, two mills have been modernized and are being run steadily; residents are anticipating the extension of the railroad from Keystone. Georgetown, only 12 mi. distant, in Clear Creek County, but separated by the continental divide, is experiencing a wonderful revival, too. With silver at the existing encouraging prices, the entire central portion of the state, from Boulder to Silverton, is brushing up all its deserted silver mines and real interest is again manifested in prospecting for this metal.

Three Important Pumping Plants are working steadily at lowering the water levels in the Leadville mines. Although the Penrose workings have been unwatered to within 18 ft. of the bottom, the flow of water has so increased that the pumps are making little headway. Water has been lowered 85 ft. in the Harvard shaft and the effect is noticeable in the decreased flow of water in the Wolftone, where a new pumping equipment is draining the mine to new depths. Over in Iowa Gulch, several miles southeast of the city, the old First National mines are about to be unwatered by H. H. Wallasea and associates.

Leadville Is Resuming Its Old Aspect as a busy camp. With the rising prices for metals, of which Leadville is capable of producing nearly all, the district promises to be the liveliest one in the state this summer. The unusually heavy snowfall of the last winter is impeding activities but, in the words of a well-posted resident, "every old mine that was ever worked is to be reopened." Attention is being given to the occurrence of tungsten. It is now believed that, for years past, this metal has been wasted through lack of identification of its minerals, scheelite and hübnerite—just as was the case with the non-sulphide zinc ores until about a decade ago. Tungsten is an associate of gold in the true fissures of Breece Hill, as for example in the Little Jonny and Garbutt veins. This district may soon become as excited over tungsten as have Boulder and Gilpin counties.

BUTTE—May 11

A New Mine Within The City of Helena may be the result of developments on R. A. Barrett's Jack mine, situated on the south slope of Mt. Helena within the city limits. Two veins have been cut, one containing lead-silver ore, and another carrying gold; both veins are high-grade and are about 2 ft. wide. The property is developed by a shaft and tunnel and some shipments have already been made.

Activity in Rimini District, in Lewis and Clark County, is increasing. Anaconda is working fifty men on the Porphyry Dike to determine the extent and richness of this ore for which a large mill will be erected if ore proves to be of a satisfactory grade and extent. The Monte Cristo mines have been taken under lease by W. A. Clark, Jr., of Butte, and the Barnes-King Development Co. is opening the Woodrow Wilson property on Bald Mountain. An Eastern syndicate is examining claims owned by James J. Hill in this district. Minneapolis men have purchased the old Monarch mine and will reopen it and construct a mill; this property contains silver-lead ore and adjoins the Porphyry Dike mine, under option to the Anaconda company.

Reöpening the Drumlummon Mine at Marysville is in prospect. William Mayger, who owns the controlling interest in this old mine, which at one time was the biggest gold producer in state, has announced that the property will be reopened within next two months, all litigation having been settled. The property is in good condition to start up, with exception of the mill which will require overhauling. Electric power will probably be substituted for steam. There are nearly 20 miles of tunnels, shafts and drifts. It is estimated that $15,000,000 has been taken out and that large bodies of low-grade gold ore still remain in mine. Another Marysville activity is that of the Marysville Gold Mining Co. which has acquired 30 claims and contemplates erecting a mill as soon as development has demonstrated the magnitude and value of the orebodies already opened.

Epilogue to Elm Orlu and Butte & Superior Litigation—According to the decision rendered some time ago by Judge Bourquin in this famous case, an accounting was to be had of the ore taken out by either company from the other company's ground, prior to the decision which defined the extent of territory belonging to each. The matter is now being threshed out before Judge Bourquin and the court is asked to render a decision as to the value of the ore removed by Butte & Superior from what the court has decreed is Elm Orlu ground. It has been agreed that the amount of ore in dispute is 31,825 tons on which the Butte & Superior company's statement shows a profit of approximately $23,000. Mining costs are not at issue but the Elm Orlu company has sought to show that wasteful, or at least not the most economic methods were employed in reducing the ores. It is contended by the Elm Orlu company that the Butte Reduction Works, at that time a Clark concern, obtained a greater extraction from these ores than was achieved at Basin, where the Butte & Superior company treated its ores prior to building its Butte mill. Manager Bruce of the Butte & Superior said that he considered 65 to 70% a fair recovery for a concentrating mill at that period.

SALT LAKE CITY—May 11

Smoke Suits are again pending against the United States Smelting Co. and the American Smelting and Refining Co. Hearing was begun on May 8 before Judge Tillman D. Johnson in the United States District Court in the case of H. J. Wheeler, who asked for a permanent injunction restraining the smelting companies from operating their respective plants at Midvale and Murray. Later the case of John A. Anderson was substituted for that of H. J. Wheeler, to which it is in many respects similar.

The Great Activity in the Cottonwoods has resulted in co-operative effort to improve the road down Big Cottonwood Cañon. This is now being widened to permit of hauling by auto-truck. About 100 men are at work grading the road, the expense of which is to be shared by Salt Lake County, Salt Lake City and mining companies operating in the cañon. At Alta in Little Cottonwood shipments have been held back by a bad stretch of road, covering about a mile immediately west of Alta townsite in front of Superior Gulch. Mining companies are planning to combine to furnish a large force of workmen to clear away the snow here. The work will require but a few days, after which shipments can be made regularly to the railroad at Wasatch, 9 mi. below Alta.

ELY, NEV.—May 12

Tungstonia, the new camp at the north end of the Snake Range tungsten belt, is one of the richest portions of the entire zone, and is attracting much attention. The most important operation at present is that of the Ophir Mining Co., controlled by A. R. Shepherd and George M. Rea, of Los Angeles. They have under option a group of 20 claims, traversed by six or more veins, some of which have been traced for more than a mile through this and adjoining properties. They have a 20-ton milling plant that is now being increased by the installation of another 20-ton Eccleston ball mill and a Wilfley table. The original plant comprised a 20-ton ball mill, two Eccleston tables, steam engine, crusher, and other incidental equipment. A good water supply has been developed from springs near the mill, and a comfortable camp has been established. Over $25,000 worth of concentrates has been produced in the course of the preliminary operations, which were conducted somewhat as a "try-out" of the property, rather than as an effort at handling a large tonnage. The Veta Madre, from which this hübnerite ore was mined, ranges from 20 to 30 ft. wide. Most of the ore was sent to the mill without sorting. Handled in this manner, it ran from 1½ to 2% but if sorted, a much higher grade product could be obtained. Sixteen men are now on the payroll. Contiguous to the Ophir property, on the north and west, Charles Osterland and associates of Ely have a group of 21 claims, some of which cover the northerly extension of the Veta Madre. Fourteen of these claims are held under option from Dan Simonson and Hugh Hale, and others are held by location. High-grade hübnerite ore has been obtained in a number of veins that have been opened, and slabs of rich float varying from 4 in. to a foot in thickness are found on the surface of some of the claims.

OATMAN, ARIZ.—May 11

Lateral Work is now being undertaken by many of the Oatman developing companies that have reached the objective point in depth from which they will explore for commercial ore or develop veins already encountered. This applies especially to such companies as United Western, Ivanhoe, Oatman Gold, Fessenden, Arizona Tom Reed, Black Range, Boundary Cone, Gold Range and Lucky Boy.

JOPLIN—May 13

A Tariff for Zinc Ore will be the platform of Charles T. Orr, a Joplin operator, who will enter the race for Congress here this fall. It is expected that he will have the backing of local producers of zinc ore. The present Congressman, Perl D. Decker, is a democrat and voted for the Underwood tariff.

Confirmation of Merger of the Picher Lead Co., of Joplin, with the Eagle White Lead Co., of Cincinnati, has been made by O. S. Picher, president of the local company. Final details of the consolidation are to be arranged at a meeting to be held June 6. The new company will be known as the Eagle-Picher Lead Co., and general offices will be in Chicago. It will have a capitalization of $10,000,000. The Picher company is capitalized at $5,000,000 and the Eagle company at $2,000,000. Mr. Picher will move from Joplin to Chicago but, according to present plans, other officials in this district will not be changed.

ST. LOUIS, MO.—May 13

The American Zinc, Lead and Smelting Co. is considering absorbing the Granby Mining and Smelting Co. on the basis of $375 per share for the 20,000 shares which have a par value of $100.

A Suit For a Receivership has been started by a minority stockholder of the old Doe Run Lead Co. When the St. Joseph Lead Co. took over this property, nearly all of the stock was exchanged for St. Joseph stock, but a few stockholders refused to come in, so that it has been necessary to keep up the old company.

Shovelers in the Flat River District went out on a strike for higher wages on May 8, demanding more pay. They had been receiving $2.40 for a day of 8 hr. for loading 22 cars (about 1 ton per car), with a bonus of 30% extra, which gave them $3.12. The bonus system of extra pay had been adopted, as it saved the 30 days' notice that it is necessary to give if a change is made in the scale, and three advances of 10% bonus had been made in the past six months. The men have since returned to work at a slight advance, as the new scale that has been accepted is a flat rate of $3.20 per shift for loading 20 cars.

CANDOR, N. C.—May 11

Gold Mining in Montgomery County is "on the blink" again. The Uwarra mine, formerly the Montgomery, has pulled its pumps and shut down indefinitely without even leaving a watchman on the job, other than the boarding boss. The Geological Survey credits Montgomery County with a gold production of $90,000 in 1915, of which Uwarra was the largest producer. The Iola mine was closed down nearly two years ago, but subsequently sold to the Martha Washington Gold Mining Co., which owned a plat of ground adjoining both the Iola and Uwarra. This company started up the Iola Mill and operated it for a short time, but also abandoned operations, and nothing is being done now at these three properties. The old 10-stamp mill of the Montgomery, which has not operated for about 10 yr., has been dismantled and shipped to Groth & Dixon, at Moxville, N. C., and it is reported that 10 more stamps from the old Iola mill are being negotiated for by the same people.

MARQUETTE, MICH.—May 12

Members of the State Tax Commission and the state geologist held a conference in Marquette, May 11 and 12, with mine managers from the Michigan ranges. About 30 mining men were present. The object of the meeting was not to lower or raise assessments, but to figure out a better basis for making the mine valuations. The mine managers maintain that a five-year period is too short to use as a basis in making determinations. The commission averages the selling price of iron ore at Lake Erie ports over a five-year period in setting the mine valuations. It is believed that a change in the method will occur as a result of the Marquette meeting.

DULUTH, MINN.—May 11

The Ore-Carrying Steamer "S. R. Kirby" broke in two and sank on May 9, at a point 4 mi. off Eagle Harbor, Lake Superior, a distance of 194 mi. from Duluth. Of the crew of 22 men, but two have been reported saved thus far. Overloading is given as cause of accident. Steamer was owned by the Harvey H. Brown interests, of Cleveland, Ohio, and has been in service upward of twenty years.

TORONTO—May 13

Increased Wages for Silver Miners were announced on May 6 by most of the Cobalt mining companies. Underground workers will receive an additional 25c. per day from May 1. In addition all employees will receive a bonus of 25c. per day from June 1 as long as the price of silver remains over 70c. per oz. The bonus will be decided by the average New York price for the month.

About 8,000 Acres of the Gillies Timber Limit on the Montreal River in the Cobalt area will be opened for prospecting and staking from June 1, according to an announcement of the Ontario government. Portions of the limit have been opened from time to time under the supposition that silver might occur there in paying quantities, but so far mining operations have not been attended with success.

The Bill Taxing Excess Profits of mining and other companies has not yet passed its final stages in the Canadian Parliament. It has received a second reading and its adoption is practically assured. It is understood, however, that it will be a much less drastic measure in its operation than at first appeared probable, as in carrying it out assurances have been given that reasonable allowances will be made for the exhaustion of ore reserves and the risk attending mine development.

Prohibiting Exportation of Natural Gas is to be the policy of the Alberta Provincial Government. During the session of the legislature just closed a charter granted to the Northern Alberta Natural Gas Co. contained a provision limiting its operations to the province and it was declared to be the intention of the government to incorporate a similar clause in any charter hereafter granted empowering companies to supply natural gas. Projects which have recently been put forward for supplying places in Saskatchewan and Manitoba from the Alberta gas fields will consequently be abandoned.

The Mining News

ALASKA

DEVELOPMENT IN VALDEZ AND PORT WELLS districts will be undertaken during coming summer by H. W. Vance, W. A. Dickey, Galena Bay Mining Co., A. C. Baldwin, Bert Cooper and F. M. Cockrell.

CLIFF (Valdez)—Red Ellis continues to work on new strike at old Cliff mine.

GLENDENNING (Valdez)—J. G. Galvin and associates have bonded this copper property in Port Wells district.

BEATSON (Latouche)—Increasing output of mine. New 2,000-cu.ft. compressor ordered. W. E. Dunkle, superintendent.

KNIGHTS ISLAND COPPER (Valdez)—Will install additional equipment during summer. P. J. Bonner, superintendent.

ALASKA TREASURE SYNDICATE (Treadwell)—Development will start at once at this property 2 mi. below Treadwell on Gastineau channel. M. S. Hudson in charge.

GRANBY CONSOLIDATED (Vancouver, B. C.)—This company preparing to operate Midas copper mine near Valdez on larger scale. Tramway and mill material en route to Valdez.

PANDORA (Valdez)—This group of copper claims on Knights Island, near Valdez, bonded to New York syndicate. Vein said to be 40 ft wide; carries copper and small amount of gold.

ALASKA MINES CORPORATION (Valdez)—Shipping copper ore from property at Fidalgo Bay. Has also acquired additional properties on Knights Island. E. D. Reiter, manager.

VALDEZ GOLD CO. (Valdez)—This company will operate reorganized Cameron-Johnson property under superintendency of Jack McDougall. Air compressor and drills will soon be installed. G. S. Rankin, Seattle, Wash., president.

ALASKA JUNEAU (Juneau)—Work progressing rapidly on new mill; some concrete forms removed from mill foundations. First consignment of steel for mill has arrived and work on power house is nearing completion. Manager, P. R. Bradley.

ALASKA TREADWELL (Treadwell)—Sinking continues in both Central and Mexican shafts. Walter Stevens, mine foreman, is in charge at Treadwell shaft and Peter Johnson at Mexican. Good progress is being made in both shafts with Sullivan drills hitherto not much used in this district.

ARIZONA

Cochise County

REPUBLIC (Johnson)—Shipping daily about 200 tons of 4% copper ore to El Paso smeltery.

BLACK PRINCE COPPER CO. (Johnson)—Started work with small force cutting station on fourth level; new machinery ordered and drifting will follow its arrival.

SHATTUCK ARIZONA (Bisbee)—April production was 1,366,830 lb. copper; 130,570 lb. lead; 19,849 oz. silver and 353.57 oz. gold. Copper production for four months, 6,049,521 lb.

COPPER CHIEF (Johnson)—New Sullivan compressor is on ground, oil tanks and new oil-burning boiler being installed; on completion of this work, output will be greatly increased.

IRON CAP (Copper Hill)—Good ore opened on ninth level. Iron Cap shaft being retimbered; new headframe in place, hoist, compressor, ore bins and railroad spur being installed. March production, 230,690 lb. copper.

Mohave County

OATMAN CRESCENT (Oatman)—Compressor in position and contract for driving tunnel will soon be let.

Pima County

DURHAM RANCH COPPER PROPERTY in the Tortillita Mountains is being drilled for the U. S. Smelting, Refining and Mining Co. by engineers under direction of F. B. Weeks, who recently arrived in Tucson to make examinations of a number of properties.

GOULD (Tucson)—Walter Wakefield and associates, of Tucson, making preparations to unwater and repair old shaft.

AJO CONSOLIDATED (Ajo)—New machinery installed; crosscutting and drilling in progress; reported deal to transfer property to Eastern men.

Yavapai County

LINCOLN (Crown King)—Ten-stamp mill going into operation.

CALIFORNIA

Amador County

COLOMA HILL where Marshall discovered gold in 1848 is still producing large nuggets. Two prospectors, Frank Amsterdam and George Patrick, recently went prospecting on the hill and after three hours work took out nuggets aggregating $120. Recently a bridge contractor, getting gravel for concrete work near this point, constructed a sluice and washed the gravel for gold before using the concrete and made money out of it.

Butte County

BLUE HOG (Magalia)—This drift mine now being operated by San Francisco men. J. Evans, foreman.

EUREKA (Magalia)—Option on this mine, owned by Thomas Mugford, exercised before maturity. C. Crowder, of Chico, interested.

Eldorado County

CHROME ORE to the amount of 50,000 tons reported to have been taken under option by William Amstalden. Deposits are in the vicinity of Salmon Falls and Negro Hill. Many prospectors out.

RED WING (Placerville)—High-grade ore reported from 100 ft. drift. A 2-stamp mill for development purposes is in operation.

VIRGIN AND VALENTINE (Placerville)—Tungsten reported discovered in the Virgin, and half-interest in the two claims sold to John McCloud, of Nevada City by William Judson.

Kern County

SIDNEY POINT (Randsburg)—F. Moon has leased this property which includes the White gold mine; vein of high-grade scheelite found on 200-ft. level.

Marin County

POTASH RECOVERY CO. (Sausalito)—Formed for manufacture of chemical products, especially potash and other fertilizers from distillery waste under patented process, 500 shares of common stock issued H. O. Chute and John D. Spreckels, Jr., in exchange for license to use the process.

Napa County

CORONA QUICKSILVER (Vallejo)—James B. McCauley reported to have shipped 25 carloads of rich retort ore; treatment plant to be installed at head of James Creek near Oathill.

PITTSBURGH GOLD MINING CO. (Nevada City)—A 1,000-ft. crosscut being driven from the Pittsburgh shaft to the Gold Flat ground which produced high-grade quartz in upper workings.

Plumas County

MURDOCK COPPER (Quincy)—Preparations being made for resumption. Mine shipped last season.

MOHAWK MINING (Quincy)—Work resumed, 14 men employed. Expect to start shipping copper ore again.

SENECA CONSOLIDATED (Greenville)—Reported that plans contemplate larger mill and cyanide equipment.

WALKER COPPER (Portola)—Operations temporarily suspended pending settlement of misunderstanding between owners. Plans in progress for completing installation of concentrating plant with capacity of 100 tons per day.

San Bernardino County

ATKINS, KROLL & CO. shipped 210 tons of tungsten concentrates from the Atolia mill in April.

BOREHAM & PHILLIPS, 12 mi. north of Kelso, made initial shipment of car of lead ore. If returns warrant they will develop property.

Sierra County

SIERRA DEL ORO (Downieville)—More ore encountered in tunnel now being driven by W. I. Redding and associates.

BUTTE SADDLE (Sierra City)—Bonded to E. B. Barnett. Surface improvements being made. New lower tunnel will be driven.

WHITE BEAR (Downieville)—Work resumed in New York tunnel to find northern extension of White Bear channel. John Costa, lessee.

BRANDY CITY HYDRAULIC MINES (Brandy City)—With abundant water supply, now hydraulicking, three shifts, with good returns. George F. Taylor, manager.

YORK (Downieville)—Finney Mines, Inc., of 825 Tenth St., Sacramento, incorporated May 1 to take over option. Reconstruction of ditch, flume and power line completed. Unwatering and sinking of old shaft to begin June 1. G. B. Morse in charge.

Siskiyou County

CHROME DEPOSITS recently found about 10 mi. from Happy Camp in Elk Creek. Reported that formation can be traced for a length of 1,200 ft.

DAKIN (Happy Camp)—Copper claims bonded to F. Dakin, Jr., by Thurman Crumpton and John Maddox. Ore contains copper and gold.

MT. VERNON (Yreka)—This old mine, on divide between Yreka and Deadwood, leased by J. S. Dobyns, of Butte, Mont. Lower tunnel driven 600 ft. disclosed 3-ft. vein carrying milling ore.

ANDERSON & CO. (Happy Camp)—Developing property in Oak Hollow in the divide between Happy Camp and Nolton. Installing 5-stamp mill. Water will be taken from Siskiyou Mines Co. ditch, out of Thompson Creek.

KLAMATH PLACER (Scott Bar)—Reported that Martin Andrew and George Milne have sold 153 acres of placer ground to R. J. Barber, of Boston. Property has been worked with two giants and two more are contemplated.

Tuolumne County

LIVE OAK (Jamestown)—Development progressing satisfactorily; shipping to Black Hawk mill; ore largely free milling.

NYMAN CONSOLIDATED (Jamestown)—In last nine months, 5,525 tons mined and milled, yielding $5.63 per ton. Charles E. Shafer, manager.

SPRINGFIELD TUNNEL (Columbia)—Heavy blast in roof of tunnel exposed 4 ft. of rich gravel on Apr. 29, at a point beneath the old Buchanan channel, bench gravels of which were worked in early days. Gravel just opened is 414 ft. beyond old workings.

Ventura County

U. S. BORAX CO. is permitted by Corporation Commission to sell $300,000 of its 5%, 30-year bonds. Bonds are secured by trust deed covering borax mines and properties in Ventura and Kern Counties and are to be issued to Borax Consolidated, Ltd., of London, in payment of approximately $302,000 indebtedness.

COLORADO

Lake County

WESTERN ZINC OXIDE CO. (Leadville)—Has elected new directors as follows: H. T. Sheffield, C. N. Brooks, J. B. McDonald, C. H. Collins and John Eberville. New buildings being erected by contract.

San Juan County

RUBY (Silverton)—Property in Maggie Gulch being vigorously developed by Holman and Stich who have opened 5-ft. quartz vein containing stringers of hübnerite.

CROWN JEWEL (Silverton)—Gray copper ore, carrying high gold and silver, opened in Diamond tunnel under Emerald property on Anvil Mountain. Under lease by Andren, Jackson and Gustafsen.

Teller County

ELKTON (Elkton)—Main shaft now timbered to within 100 ft. of station at Roosevelt tunnel level.

UNITED GOLD MINES (Cripple Creek)—New officers, succeeding Milliken management, are: A. E. Carlton, president; H. McGarry, vice-president and general manager; Richard Roelofs, Leslie G. Carlton and Irving T. Snyder, directors; R. C. Wilson, secretary-treasurer; L. J. Russell, superintendent.

IDAHO

Shoshone County

SUCCESS (Wallace)—Mill again operating at capacity. New orebody opened by short crosscut from main shaft at 1,300-ft. level. April profits, about $90,000.

HERCULES (Burke)—Hercules production in 1915 was 49,441 tons of ore and concentrates; gross value, $3,090,174; mining cost, $950,852; transportation and reduction, $986,219; betterments, $57,084. This property previously premier producer in the Cœur d'Alenes fell into third place last year; was closed three months owing to nonrenewal of smelting contract.

MICHIGAN

Copper

AN AIR BLAST on May 10 shook Houghton and Hancock severely and did considerable damage in lower workings of Quincy; slight damage sustained by several other mines.

WINONA (Winona)—With completion of new shafthouse, production which has been about 200,000 lb. monthly will be increased.

KEWEENAW (Mandan)—Operations will be extended when mill now nearing completion is ready to go into commission.

HANCOCK—(Hancock)—Producing over 400 tons daily from Pewabic lode through main shaft; this rock averages only about 17 lb. per ton, but is profitable under present conditions. More men are being employed and production will be increased.

QUINCY (Hancock)—From No. 7 shaft, this mine shipping Pewabic rock and stoping on larger scale will soon be under way. Rock is of higher grade than that secured from main Hancock shaft, running nearly 20 lb. per ton.

Iron

EMPIRE (Palmer)—Mine being unwatered. Operations will start in three or four weeks. No ore in stock at present.

AMERICAN (Diorite)—Big cave occurred to the west of mine. Expected for some time. Mine now considered safer.

OHIO (Michigamme)—Two shifts now being worked. First ore shipped two weeks ago. Only mine working in Michigamme field. Portland to start in few weeks.

ODGERS (Crystal Falls)—First ore shipped last week. Little mining being done. Mostly development work. In another month mine should ship steadily. Shaft started last fall; now bottomed and drifts being extended to ore.

ANGELINE (Ishpeming)—Operations discontinued. Allege difficulty in disposing of high-grade bessemer ore mined here. Better demand for the high-phosphorus grades. Property will be worked when market demands change. Ore runs as high as 69% in iron.

CLEVELAND-CLIFFS (Ishpeming)—Prices for explosives quoted, p. 836, May 6, are reported incorrect; Aetna Explosives Co. office at Duluth quotes as follows for Upper Peninsula iron mines: 40% standard dynamite, 13¼c. per lb.; 50% dynamite, 14¾c., and 60% dynamite, 16¼c.

MISSOURI-ARKANSAS

Joplin District

KING SOLOMON (Melva)—Drained and will be operated by Joplin mining men.

NATIONAL (Joplin)—Constructing new 200-ton mill on Empire land south of city. Ore found at 70 ft.

NAVY BEAN (Wentworth)—Sold to Tulsa, Okla., men, who will erect 300-ton mill. Includes 300 acres of ground.

SAM HILL (Joplin)—Making good output of calamine and has just broken into lower run of blende, with some lead.

BONEHEAD (Lawton)—Mine recently taken over by new company. As John A. Hall mine, this property has been fair producer.

PERKINS (Granby)—Second tailing mill started by E. T. Perkins & Co., making 30 tons calamine per week. Mill modern and electrified.

WHAT CHEER (Duenweg)—Fire in tailing pile for three hours when 4-in. gas line under it broke. Mill threatened but saved by hard work. Entire pile appeared on fire. Burned long after gas was cut off.

Northern Arkansas

CHARLEY BOY (Buffalo)—New 150-ton mill started.

YELLOW ROSE (Rush)—Producing 15 tons concentrates per day.

RISING SUN (Zinc)—Old Jack Pot mill remodeled and mining started.

ALMY RED (Zinc)—Expending $10,000 in rebuilding mill. Operating tunnel and shaft.

PHILLIPS (Yellville)—Good ore face exposed in shaft at this mine; mill just purchased in Joplin.

MONTANA

Broadwater County

KEATING (Radersburg)—Will construct 150-ton mill to cost $50,000; second unit to follow on completion of first. Ore, averaging $20, being mined at present on 300- and 700-ft. levels. Shaft will be sunk 300 ft. from present depth of 1,200 ft.

Granite County

BASIN (Phillipsburg)—Work commenced at this placer mine with improved equipment, including Hungarian riffles and Pulsator jigs.

Lewis and Clark County

MONTE CRISTO (Rimini)—W. A. Clark, Jr., of Butte, has lease and is driving tunnel.

MADDEN (Helena)—Crosscut tunnel intersected gold vein, 395 ft. from portal, at depth of 110 ft.

LOLA C. (Augusta)—Several veins of rich lead ore, carrying some gold and silver, exposed by recent development. Tunnel started to explore at depth.

MONARCH (Rimini)—Minneapolis men have purchased this silver-lead property. There is tonnage of low-grade ore opened and new owners will erect mill.

HEAD (Helena)—Scratch Gravel Gold Mining Co. will sink shaft to 500-ft. level as soon as new steam plant can be installed at this mine. Eight cars shipped to East Helena smeltery during last half of April.

Fergus County

BARNES KING (Kendall)—Company's April production was smallest for many months, having devoted attention largely to development work. Total receipts from bullion from Piegan-Gloster and North Moccasin mines was $34,900. At Piegan-Gloster 2,933 tons were mined and milled, yielding $4.09 per ton; at Moccasin, 3,592 tons, yielding $6.37 per ton.

Madison County

MINES DEVELOPMENT CO. (Silver Star)—This Butte company has leased Green-Campbell mine and will install machinery at once. Mine worked in past for copper but mill constructed for treating complex ores was not a success.

Mineral County

INTERMOUNTAIN (Iron Mountain)—Mill now treating 65 tons of old Amador dump ore, running 2½% copper; concentrates to 14 to 18%. Beginning May 15, 110 tons of ore will be mined and milled.

Silver Bow County

BUTTE-COLUMBIA MINING CO. (Butte)—Driving tunnel to develop 33 claims in eastern section of Butte district, south and east from Columbia Gardens.

TUOLUMNE (Butte)—Capital stock increased from 800,000 shares to 2,500,000 shares of par value of $1 and directors authorized to sell or trade property.

BUTTE-BALLAKLAVA (Butte)—Company expects within a week to resume normal output and hoist 200 tons per day, averaging 3½% copper. On 1,800 level, oreshoot is 23 ft. wide. On 2,200 level, 4 ft. of 8% ore was opened. Average from two levels is expected to run over 4%.

ANACONDA (Butte)—Although developing old Lexington silver mine for its zinc ores, claims are still owned by Atlantic Mines Co., organized three years ago to take over property of La France Copper Co., one of the Heinze corporations. Atlantic company proposes to sell property to Anaconda for $12.50 per share; 100,000 shares outstanding.

NEVADA

Esmeralda County

GRANDMA CONSOLIDATED MINES CO. (Goldfield)—Company organized to acquire Grandma property east of Kewanas. Three-compartment shaft started.

REORGANIZED CRACKERJACK (Goldfield)—Placing compressor and hoist at old 320-ft. shaft which will be repaired. Active underground development will follow.

FLORENCE GOLDFIELD (Goldfield)—Development near old bonanza workings on 250- and 530-ft. levels has blocked tonnage of low-grade ore amenable to flotation. Company may acquire flotation plant erected by leasers on site of old mill.

JUMBO JUNIOR (Goldfield)—Fractional claim, joining Velvet of Jumbo Extension on northeast, will be explored from Velvet shaft at 890-ft. or shale-contact level. Apex litigation eliminated by agreement to pay Reorganized Booth Mining Co. $10,000 from proceeds of ore extracted.

GOLDFIELD CONSOLIDATED (Goldfield)—Estimated production for April follows: Tons mined, 30,400; extraction, $222,000; expenses, $162,000; realization, $60,000. March final report showed net profits $54,127 from 30,000 tons. Success of 50-ton pilot plant has induced company to order flotation equipment for large plant.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Strike of high-grade ore reported on the new 1,600-ft. level, considered continuation of high-grade orebody found on upper levels. Frank Bird, superintendent.

SEVEN TROUGHS MINING CO. (Vernon)—At recent annual meeting both factions agreed to coöperate and development will be started on 700-ft. level of Fairview mine. L. A. Friedman, of Lovelock, reëlected president.

Nye County

TONOPAH ORE PRODUCTION for week ended May 6 was 6,552 tons, valued at $143,196, compared with 8,569 tons for week previous. Producers were: Tonopah Belmont, 2,864 tons; Tonopah Extension, 1,850; Jim Butler, 800; West End, 485; Rescue-Eula, 193; Halifax, 182; North Star, 58; miscellaneous leases, 120 tons. This does not include production of Tonopah Mining Co. as milling was interrupted by power trouble.

BIG FOUR (Manhattan)—Leased for one year to C. F. Wittenberg and associates. Mill being overhauled.

TONOPAH MINING (Tonopah)—Mill again running three shifts; improvements made while repairing fire damage.

TONOPAH BONANZA (Tonopah)—Shaft being sunk by contract. Now down 1,435 ft. with 1,500-ft. point as objective where station will be cut and pumps placed.

RESCUE-EULA (Tonopah)—During April company shipped about 800 tons; estimated profit, $12,000. Raises Nos. 1, 2, 3 and 4 on the shoot continue in mill ore and station being cut to sink winze in the ore. New bins with grizzlies and sorting floor completed.

MIZPAH EXTENSION (Tonopah)—Property operated under option by Tonopah Mining Co. Sinking of main winze below 1,155-ft. level and lateral development on 1,214-ft. level continues. Stoping of flat low-grade vein to be undertaken on limited scale to determine possibility of profitable extraction.

Storey County

ANDES (Virginia)—Saved 18 cars of ore and started cleaning out old winze.

CON. VIRGINIA (Virginia)—South drift, 2,700 level, shows 4-ft. vein carrying quartz and clay, at 75-ft. point.

MEXICAN (Virginia)—Mill down 4 days for cleanup and general repairs. Mill crushed 140 tons custom ore.

SIERRA NEVADA (Virginia)—East crosscut from bottom of winze below 2,500 level passed through 7 ft. of mineralized quartz.

OPHIR (Virginia)—Main north drift, 2,500 level, opened to 470-ft. point. North drift, 2,700 level, in porphyry and quartz of better value.

CROWN POINT-BELCHER (Gold Hill)—Saved 103 cars of ore from No. 3 stope, 1,600 level. Jacket mill received 69 tons mine ore and 656 tons dump rock.

UNION (Virginia)—Extracted 244 tons as follows: 2,400 level, No. 4 stope, 36 tons, $30.17; No. 5 stope, 142 tons, $47.79; 2,500 level, No. 1 stope, 66 tons, $11. North drift, 2,700 level, repaired to 350-ft. point. Union shaft repaired to 405-ft. point below 2,000 level.

TEXAS

EL PASO SMELTING WORKS (El Paso)—Plant running at capacity and yards filled with cars. Shippers notified to reduce shipments to minimum.

FREEPORT CHEMICAL WORKS (Freeport)—This company, representing the Stauffer Chemical interests of San Francisco, will erect a sulphur-refining plant to refine sulphur from the Freeport Sulphur Co.'s wells. Latter company now using about 3,000 bbl. of fuel oil daily in its three "steaming" plants.

UTAH

Juab County

TINTIC SHIPMENTS for week ended May 5 amounted to 208 cars, the largest weekly output in years.

MAY DAY (Eureka)—April earnings were about $5,000; shipping monthly about 100 tons of lead ore and 200 tons of zinc ore.

DRAGON CONSOLIDATED (Silver City)—Shipments amount to about 500 tons of shipping ore monthly; 70 tons daily of low-grade ore to Tintic Milling Co.; and 200 tons daily of iron ore to Valley smelters.

SCRANTON (Eureka)—At annual meeting, May 11, new directorate elected, consisting of T. G. Wolf, H. A. Knapp, B. H. Throop, of Scranton, Penn., and R. J. Deighton and W. H. Bramel, of Salt Lake. Mine working under leasing system two months; seventeen cars of zinc ore and seven cars of lead ore shipped.

Salt Lake County

UTAH COPPER (Bingham)—Rough estimate places April output at about 14,000,000 lb. as compared to 12,714,651 lb. in March.

ALTA TUNNEL AND TRANSPORTATION (Brighton)—Small body of high-grade silver-lead ore cut in this tunnel, now in over 2,000 ft.

UTAH APEX (Bingham)—March operating profits were $107,936; silver production, 70,827 oz.; lead, 4,104,818 lb.; copper 260,072 lb.

SOUTH CARDIFF (Salt Lake)—Articles of incorporation filed, 1,000,000 shares, par value 1c. G. N. Lawrence, president. Company owns 87 acres short distance from the Cardiff.

Summit County

ONTARIO (Park City)—During April Federal Leasing Co. shipped 294 tons from levels above the 1,500. The 1,500 and 1,700 levels being worked by company, which shipped 483 tons. Company is stated to have on hand 120,000 oz. silver.

SILVER KING CONSOLIDATED (Park City)—This company is beginning extensive enlargements and improvements. Preliminary work begun on concentrating mill, and an aërial tramway will be built connecting the mill with the railroad. Work has also begun on tunnel to develop Thaynes Cañon section of property. Shipments, for some time held back by bad roads, now being made regularly.

Utah County

BAY STATE (American Fork)—A survey is being made preliminary to beginning development.

MILLER HILL (American Fork)—Leasing company being formed to operate this property with view to searching for the continuation of ore-bearing fissure in the Pacific.

PACIFIC (American Fork)—New ore, recently opened 500 ft. below surface by means of tunnel, has been drifted on to the north and south and both faces are still in ore.

Washington County

AT GOLDSTRIKE preparations for work during summer are being made at several properties in old Bull Valley section near Modena. Men are working at Virginia; and Goldstrike Bonanza and Hassayampa are getting ready to begin work. Bonanza will sink its shaft to 200 level; for this purpose assessment of 1c. a share levied.

WASHINGTON

Snohomish County

NORTHWEST CONSOLIDATED MINING CO. (Monte Cristo via Silverton)—Contract let to Bayside Iron Works, of Everett, for aërial tramway to convey copper ore to railroad.

Stevens County

METALINE CONSOLIDATED (Metaline)—Will resume development on old M. & M. property.

METALINE ORIOLE MINING CO. (Metaline)—Capital increased to resume development and install 50-ton mill. Fred N. Davis, manager.

LEAD AND ZINC CO. (Metaline Falls)—Shipping two cars weekly of high-grade zinc concentrates; also two cars monthly of carbonates. Installing 11 more Overstrom tables and will add another ball mill.

LOON LAKE COPPER CO. (Loon Lake)—Shipments of hand-sorted ore being made from this copper mine, 6 mi. north of Loon Lake. Ore being taken from old Clark tunnel and from both shafts above the water level.

CANADA

British Columbia

QUEEN MINES (Salmo)—This group of gold mines reported optioned to J. R. Rutherford, representing Tonopah-Belmont company.

ECHO SILVER-LEAD CO. (Nelson)—This company being organized by L. J. McAtee, of Spokane, to develop Echo group near Standard mine at Silverton.

UTICA MINES CO. (Slocan)—Shipments, first quarter, 230 tons lead concentrates and 20 tons zinc concentrates, estimates profits $8,822. Will sink on east vein from No. 4 level; west vein being developed on No. 3 level.

EFANJAY GOLD MINING CO. (Salmo)—This company recently organized to take over Fawn gold group in Sheep Creek district. Four-stamp mill of adjoining Nugget property leased to handle output from small high-grade vein. J. A. Irvine, of Spokane, Wash., president.

Ontario

COBALT SHIPMENTS in April, over Temiskaming & Northern Ontario Ry., were: Beaver, 38.54 tons; Buffalo, 62.55; Cobalt, 84.37; Coniagas, 86.37; Crown Reserve, 124.88; Kerr Lake, 128.25; La Rose, 87.59; McKinley-Darragh, 163.09; Mining Corporation of Canada, 288.07; Peterson Lake (Seneca-Superior ore), 46.95; Temiskaming, 39.68; total, 1,150.34 tons. Casey Cobalt (New Liskeard), 30.64 tons. Alexo nickel mine (Porquois Junction) shipped 700 tons.

COLUMBUS (Cobalt)—Work resumed on this prospect.

KERR LAKE (Cobalt)—Production during April 225,423 oz.

ROCHESTER (Cobalt)—High-grade vein, 1½ in. wide, found on 300-ft. level.

RED JACKET (Cobalt)—Leased by Homer Gibson, who will form a syndicate to operate.

SILVER QUEEN (Cobalt)—Work resumed under old management with A. Grierson in charge.

BEAVER (Cobalt)—Deep shaft to reach lower contact of diabase and Keewatin now down about 1,600 ft.

GREEN-MEEHAN (Cobalt)—Edwards-Kingsville Syndicate, which now controls this property, has put 14 men at work.

TRETHEWEY (Cobalt)—Experimenting with flotation process for treatment of tailings, of which large tonnage is available.

VIPOND (Porcupine)—Davidson vein broken into about 20 ft. each way from crosscut on 500-ft. level, showing good grade of ore.

McKINLEY-DARRAGH (Cobalt)—Raise put up from 200-ft. level on Vein 20 for 10 ft. is in ore, 3 in. wide, running 2,000 oz. a ton.

COCHRANE (Cobalt)—This property, adjoining Temiskaming, has been taken over on 30-day option by Crown Reserve and is being unwatered.

HOLLINGER (Porcupine)—Excavation begun for addition to mill, which will contain 100 more stamps and 10 additional tube mills. Capacity expected to be 3,500 tons per day.

MEXICO

ESPERANZA (El Oro)—Milling resumed Apr. 22.

BOLIVIA

CERRO DE PASCO MINING CO., of Lima, Peru, recently had a representative in Bolivia looking over tin properties.

HAYDEN, STONE & CO., of Boston, are reported to be negotiating for tin mines of the Cia. Agricola y Minera de Oploca at Chocaya and the adjoining property of the Aramayo, Francke Mines, Ltd.; also reported negotiating for Llallagua, which adjoins famous Uncia mines of S. I. Patiño.

AFRICA

GOLD PRODUCTION in Rhodesia in March was 80,205 oz., an increase of 5,034 oz. over February. For three months total value of gold produced was $4,645,070, an increase of 12.4% over last year. Other mineral production in February included 18,025 oz. silver, 288 tons copper, 323 tons asbestos, 6,300 tons chrome ore and 35,388 tons coal.

The Market Report

Metal Markets

NEW YORK—May 17, 1916

All of the markets were dull. Spelter was very weak. In copper and lead there were no special features.

Copper, Tin, Lead and Zinc

Copper—But very little domestic business was reported. A small volume of export business was done, some of it for deliveries as far ahead as February, 1917. There was but little demand for near-by copper, and on the other hand but little offered for sale. The most noteworthy feature, however, was offerings for resale by domestic consumers. This trimmed off the previous premium for early delivery. On May 16 May copper was offered at 29½c., r. t. The major market continues to be in copper for delivery from August to October, and sales for that delivery were made at 29c., cash, New York, without change during the week.

Copper Sheets, base price is 37½c. per lb. for hot rolled and 38½c. for cold rolled. Usual extras charged, with higher prices for small quantities. Copper wire is 33½@33¾c. per lb. for large lots at mill.

Tin—Business was very light. The market was simply dull and steady.

Lead—Reports were conflicting, some producers having done good business, while others did none at all in spite of offerings at concessions. Following the large export sales that were made on May 10, some further foreign business was done with Japan, while a considerable volume of business in small lots was done with a variety of foreign countries, showing that it was cheaper to buy lead here at domestic prices than to buy it in London. At the same time a moderate volume of domestic business was done. Toward the close there appeared to be a little more uncertainty than there had been and more of a difference in the views among producers.

Spelter—As in the previous week, business was so light that there could scarcely be said to be a market, and quotations are based largely on offers. Certainly there was no broad market. Prices declined on liberal offerings by producers, which became lower from day to day. The business that was done was chiefly for June-July and June-July-August deliveries, the supplies available for those months being apparently ample, especially for July and August. The supply for early delivery has been increased not only by the expanding production but also by the cancellation of orders by consumers. A disturbing feature was the renewal of offers to resell by consumers, some considerable quantities being talked about, and the overtures being made in not the wisest way. High-grade spelter is reported offered at 25c., and intermediate at 20@20½c.

Zinc Sheets—Market is weaker and owing to decrease in price of raw material sheets went off a cent a pound. Base price is $24.50 per 100 lb. f.o.b. Peru, Ill., less 8% discount, for carload lots.

Other Metals

NEW YORK—May 17

Aluminum—The market is steady and with little change. Contract deliveries are good, but there is not much outside metal to be had. Quotations are 58@60c. per lb. for No. 1 ingots, New York.

Nickel—The market is rather active with a good demand for export in addition to the usual requirements. Quotations are steady at 45@50c. per lb. for ordinary forms; with 5c. additional for electrolytic nickel.

Antimony—There is practically no market for antimony. The decline in price has scared out buyers and no concession on the part of the sellers will bring sales. The quotation for spot at 31@32c. per lb. is purely nominal. Shipment from China within one month is quoted at 25@26c. per lb., c.i.f., New York, duty unpaid.

The Antimony Smelting and Refining Co., of Seattle is building a plant at Van Asselt, Wash., to treat about 20 tons of ore daily. The ore will be brought from Idaho, Oregon, British Columbia and Alaska. The products will be antimony regulus or oxide and refined antimony. W. D. Wood of Seattle is president; C. M. Philipson, superintendent and chemist.

Quicksilver—The market held at $95 per flask of 75 lb. until Tuesday, when the price dropped to $90. Although the market is dull and sagging, there is some showing of a renewed interest at this price. San Francisco reports $95 market quiet.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.25 per lb., New York. The London price is 11s. per lb.—**Cadmium** is quoted at $1.25@1.50 per lb.—**Cobalt** is $1.25 per lb.—**Magnesium** is quoted at $5.50 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to quantities.

DAILY PRICES OF METALS IN NEW YORK

May	Sterling Exchange	Silver, Cts. per Oz.	Copper: Electrolytic, Cts. per Lb.	Tin: Spot, Cts. per Lb.	Lead: New York, Cts. per Lb.	Lead: St. Louis, Cts. per Lb.	Zinc: St. Louis, Cts. per Lb.
11	4.7563	76½	28⅜ @29⅜	49	7.50	7.35	@15½
12	4.7563	77¼	28⅜ @29¼	49	7.50	7.37½ @7.42½	14 @15
13	4.7563	77⅛	28⅜ @29¼	49	7.50	7.37½ @7.42½	13½ @14¼
15	4.7569	75½	28⅜ @29¼	49	7.50	7.37½ @7.42½	13½ @14½
16	4.7563	75¾	28⅜ @29¼	49	7.45 @7.50	7.35 @7.42½	13½ @14½
17	4.7569	75¾	28⅜ @29¼	49	7.45 @7.50	7.35 @7.42½	13½ @14½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts,etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

May	Silver	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic £ per Ton	Copper: Electrolytic Cts. per Lb.	Tin: Spot	Tin: 3 Mos.	Lead: £ per Ton	Lead: Cts. per Lb.	Zinc: £ per Ton	Zinc: Cts. per Lb.
11	36⅞	141	135	154	32.79	198	197¾	34¼	7.29	98	20.87
12	37	141	136	156	33.21	198	197½	33¾	7.19	96	20.44
13	36 15/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	36⅞	143	140	158	33.64	197	197	33½	7.13	98	20.87
16	36¼	146	143	158	33.64	197½	197⅜	33¾	7.19	95	20.23
17	36¼	145	143	158	33.64	197¼	197½	32⅝	6.92	95	20.23

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

Gold, Silver and Platinum

NEW YORK—May 17

Gold receipts at New York during the past week included about $4,400,000 from Canada, chiefly from Ottawa.

Gold production of the Transvaal in April was 754,672 oz., being 42,017 oz. less than in March, but 10,592 oz. more than in April, 1915. For the four months ended Apr. 30 the production in values was $59,720,177 in 1915, and $63,920,362 in 1916; an increase of $4,200,185, or 7%, this year.

There are reports that the Chinese Government is considering the establishment of a gold currency. It cannot be expected that such a measure can be carried out for a long time to come.

Platinum—The market is very quiet and little business has been done. Sales have been made at $80 per oz. for refined platinum, off from $85 last week. Hard metal is about $4 per oz. higher. Scrap platinum brings $70 to $79 per oz., depending upon its condition and circumstances.

Our Russian correspondent writes that the platinum business is generally without change. The government now accepts platinum taken by it at the price of 67,305 rubles per pood. Therefore the prices on private sales have risen to the last price. The large companies have renewed the development work for the summer operation. Two dredges are ordered for the platinum mines in the North Ural (Nicolo-Pavdinsky Co.) at the Bucyrus works; they are of 7½ cu.ft. size. For the last fortnight some poods have been sold in Petrograd to export in Japan at the price of 68,000 rubles. The quotations are, in Petrograd, 67,000@68,000 rubles per pood; at Ekaterinburg, 17.50 rubles per zolatnik. These prices are for crude metal, 83% platinum, and are equal to $66.15 and $6.58 per oz., respectively.

Silver—Market after very erratic changes for a few days following the decline to 35 1/16d. has become more steady at 36⅛@36¼d. The underlying conditions do not seem to have changed, but the speculative feeling has moderated, and the legitimate demand has slacked off to some extent.

Coined Silver in the United States May 1 is estimated by the Treasury Department as follows: Standard dollars, $568,270,900; subsidiary coins, $187,569,944; total, $755,840,844, which is $2,500,300 more than on May 1, 1915. Of the silver dollars $487,472,288 are held in the Treasury against silver certificates outstanding.

Zinc and Lead Ore Markets

JOPLIN, MO.—May 13

Blende, high price, $108.10; per ton, 60% zinc, premium ore, $105; medium grades, $100@80; no market on lower grades; calamine, per ton 40% zinc, $70@55; average selling price, all grades of zinc, $96.74 per ton.

Lead, high price, $101.50; per ton 80% metal contents, $98@96; average selling price, all grades of lead, $97.08 per ton.

SHIPMENTS WEEK ENDED MAY 13

	Blende	Calamine	Lead	Values
Totals this week..	13,826,270	910,500	2,857,440	$851,460
Totals this year..	275,186,060	24,079,040	45,836,380	$18,175,850

Blende values, the week, $679,530; 19 weeks, $15,182,360.

Calamine value, the week, $33,250; 19 weks, $905,120.

Lead value, the week, $138,680; 19 weeks, $2,087,770.

When it became generally known this evening that the demand throughout the week had been exceptionally light, with no support whatever today, it developed that buyers could not purchase on even as low as an $80 base, as none had orders for ore in any quantity or at any price. Locally it was a collapse as great in surprise to buyers as to sellers.

The shipment dropped to less than 7,400 tons and it is estimated that not to exceed 4,500 tons were purchased for future delivery. The production is likewise falling off, and indicates approximately 8,500 tons.

PLATTEVILLE, WIS.—May 13

The base price paid this week for 60% zinc ore was $103 down to $97 per ton. The base price paid for 80% lead ore was $92 per ton.

SHIPMENTS WEEK ENDED MAY 13

	Zinc Ore, Lb.	Lead Ore. Lb.	Sulphur Ore, Lb.
Week	5,244,000	181,130	655,300
Year	83,048,000	2,857,330	24,123,200

Shipped during week to separating plants 8,006,000 lb. zinc ore.

OTHER ORES

Antimony Ore maintains its nominal quotation of about $2.50 per unit for all positions.

Tungsten Ore experienced a severe drop during the week and is quoted at $40 to $50 per unit. The sudden stopping of purchases accelerated by fear of speculators that price would go still lower dropped the price to $40 per unit for prompt and forward delivery. This low price attracted some interest and the price reacted to $45 but there were no large scale transactions.

Iron Trade Review

NEW YORK—May 17

The feature of the week has been the placing of large contracts for shell steel and barbed wire for export. Domestic business has been rather quiet. The Steel Corporation's statement for Apr. 30 showed very large orders, but some of this is due to the rail orders placed in April to avoid the advance in price on May 1. Most of these orders are for 1917 delivery.

The pig-iron market is dull, with very little new business in sight just now. A new buying movement is expected soon.

The United States Steel Corporation reports the unfilled orders on its books on Apr. 29 at 9,829,551 tons. This is the largest quantity ever reported. It exceeds the quantity reported Mar. 31 by 498,550 tons, and that on Apr. 30, 1915, by 5,667,307 tons.

PITTSBURGH—May 16

The demand upon the Youngstown Sheet and Tube Co., with an answer required last Saturday, was flatly refused. A mass meeting on Sunday proved a fizzle and no serious trouble developed Monday in the Youngstown district. Labor conditions in the Pittsburgh district have continued to improve and fears of general labor disturbances in the iron and steel industry are considerably reduced.

The steel market has turned still quieter in most branches, but this is to be attributed to the fact that mills are sold up and buyers covered, since an active demand is still reflected in specifications against contracts, and in actual orders in the pipe market, in which actual orders, rather than contracts for specification in future, are the rule. The pipe mills made a new record in April for a month's bookings, and May thus far is keeping up the pace.

Pig Iron—The dullness in pig iron of late is, if possible, accentuated. There is simply an absence of inquiry. The furnaces appear to be firm in their price views, but whether that is in spite of or because of the lightness of inquiry is a question. Apparently there are very few who expect a decline, while expectations of an advance would be greater if new construction work, looking to more steel making capacity, and hence larger consumption, were proceeding more rapidly. We quote: Bessemer, $21@21.50; basic, $18.25; foundry and malleable, $18.50@19; forge, $18@18.50; f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The market has broadened further, with freer, though still very limited, offerings of soft steel. Less is heard of quotations on soft open-hearth at above $45, while there have been sales at that figure, which is substantially the quotable market for bessemer and open-hearth billets and sheet bars, with forging billets at $65@70 and wire rods at about $60. War steel specifications command various higher prices, and there is a good tonnage going in rounds, large forging billets and shells.

FERROALLOYS

Ferrosilicon very firm, demand being greater than the supply. For 50% alloy prices are nominally unchanged at $83@85 per ton at furnace; but for early delivery premiums of at least $5 are paid. Bessemer ferrosilicon is from $32 per ton for 9% up to $43 for 16%, at furnace.

Spiegeleisen is scarce and is firm at $75 per ton for 20% alloy, delivered. Last-half contracts are held at $60@65 per ton, at furnace.

Ferromanganese—The market continues rather quiet, with apparently less uneasiness as to deliveries. Spot is quotable at $350@400 and contract at $175, seaboard, with deliveries offered for second half of 1917 as well as first half.

Chemicals

NEW YORK—May 17

The general market continues fairly active and firm. Business in heavy chemicals is good.

Arsenic—White arsenic seems to be in steady demand and prices are firm. Quotations are $6.50 per 100 lb. for both spot and futures. Imports in February were 289,954 lb., against 466,016 lb. in February of last year.

Copper Sulphate—Trading has been rather quiet and prices are easier. Sales are reported at $19@20 per 100 lb., according to size and conditions of order.

Nitrate of Soda—Business is fair, but prices are again easier under the influence of large present and prospective supplies. Current quotations are $3.10 per 100 lb. for spot and $3.05@3.10 for futures.

Sulphur—The market is strong and prices are a little firmer, chiefly owing to the high cost of transportation. The present price is $30 per long ton, New York.

Assessments

Company	Delinq.	Sale	Amt.
Algomah, Mich.	May 18	.....	$1.00
Alpha, Nev.	June 7	June 28	0.03
Andes, Nev.	May 9	May 31	0.02
Benton, Ida.	Apr. 15	May 15	0.005
Best & Belcher, Nev.	June 9	June 28	0.05
Black Jack, Utah.	Apr. 11	Apr. 29	0.01
Bonanza, Utah.	Apr. 18	May 18	0.03
Challenge, Nev.	June 12	July 7	0.05
Con. Virginia, Nev.	May 19	June 9	0.05
Dennemora, Ida.	Apr. 5	May 15	0.002
Diam'dfield Black Butte, Nev.	Apr. 12	May 18	0.01
Dugway, Utah.	Apr. 24	May 15	0.0033
East Hercules, Ida.	May 1	June 1	0.0015
Echo, Ida.	Apr. 14	May 15	0.002
Elise, Utah.	Apr. 12	May 18	0.0025
Emerald, Utah.	May 15	June 10	0.0033
Emerald, Utah.	June 15	July 8	0.0033
Enterprise, Ida.	May 20	June 20	0.001
Federal Ely, Nev.	May 1	June 4	0.005
Four Timbers, Ida.	May 5	June 5	0.001
Friend, Ida.	Apr. 28	May 20	0.002
Goldstrike Bon., Utah.	June 15	July 15	0.01
Horseshoe, Ida.	Apr. 22	May 13	0.03
Idaho & Los Angeles, Ida.	June 2	July 1	0.005
Kewanas, Nev.	May 1	June 5	0.01
Lehi Tintic, Utah.	May 10	May 17	0.002
National, Ida.	June 2	July 3	0.02
Nine Mile, Idaho.	May 12	June 1	0.0015
North Bunker Hill, Ida.	Apr. 18	May 20	0.002
Old Veteran, Ida.	May 6	June 3	0.02
Overman, Nev.	May 3	May 23	0.05
Phedora, Ida.	May 9	July 1	0.005
Pioche Coalition, Nev.	Apr. 17	May 15	0.0025
Rhode Island, Ida.	Mar. 30	May 15	0.002
Sierra Nevada, Nev.	May 5	May 25	0.05
Silver Cable, Ida.	May 22	June 10	0.005
Smuggler, Utah.	May 15	June 1	0.0025
Snowstorm Ext., Idaho.	May 9	June 13	0.003
Sonora, Ida.	June 5	June 30	0.004
Spider, Utah.	Apr. 26	May 15	0.005
Tarbox, Ida.	May 6	June 20	0.05
Tiberius, Ida.	Apr. 15	May 15	0.001
Umatilla, Nev.	Apr. 17	May 22	0.005
Utah-Arizona, Ariz.	Apr. 14	May 16	0.0025
Zuma, Utah.	Apr. 24	May 15	0.0025

Stock Quotations

SAN FRANCISCO May 16 Name of Comp.	Bid.
Alta	.04
Andes	.09
Best & Belcher	.02
Bullion	.01
Caledonia	.36
Challenge Con.	.05
Confidence	‡.15
Cons. Imperial	.01
Con. Virginia	.15
Gould & Curry	.03
Hale & Norcross	.04
Jacket-Cr. Pt.	.11
Mexican	.20
Occidental	.70
Ophir	.23
Overman	.06
Savage	.04
Seg Belcher	.02
Sierra Nevada	.29
Union Con.	.60
Utah Con.	.01
Belmont	4.75
Jim Butler	1.00
MacNamara	.12
Midway	.27
Mont.-Tonopah	.33
North Star	.19
Rescue Eula	.40
West End Con.	1.10
Atlanta	.12
Blue Bell	.02
Booth	.20
C.O.D. Con	.03
Comb. Frac	.08
D'field Daisy	.03
Jumbo Extension	.94
Pitts.-Silver Peak	.07
Round Mountain	.74
Sandstorm Kendall	.06
Silver Pick	.08
Central Eureka	.08
Argo	.25
Big Jim	1.25
Lazy Boy	.28
Oatman Cres.	.41
Oatman No. Star	‡.20
Tom Reed	1.70
United Eastern	4.12½
United Western	.24

LONDON	Apr. 29
Alaska Tre'dwell	£6 10s 0d
Burma Corp.	2 4 4½
Cam & Motor	0 17 6
Camp Bird	0 8 0
El Oro	0 10 6
Esperanza	0 11 9
Mexico Mines	4 0 0
Nechi, pfd.	0 14 6
Oroville	0 15 9
Santa Gert'dis	0 12 0
Tomboy	1 3 6
Tough Oakes	‡0 11 3

SALT LAKE Name of Comp.	May 16 Bid.
Beck Tunnel	‡.22½
Black Jack	.12
Colorado Mining	.21
Crown Point	.05½
Daly-Judge	7.00
Emma Cop.	.50
Gold Chain	.31
Grand Central	.75
Iron Blossom	2.05
Lower Mammoth	.05
May Day	.15½
Opohongo	‡.02½
Prince Con.	1.32½
Seven Troughs	‡.02
Silver King Coal'n	2.90
Silver King Con.	3.10
Sioux Con.	.18
Uncle Sam	.09
Yankee	.35

COLO. SPRINGS	May 16
Acacia	‡.03½
Cripple Cr'k Con.	‡.0075
Doctor Jack Pot	.10
Elkton Con.	.23½
El Paso	.77
Findlay	.04½
Gold Sovereign	.03½
Golden Cycle	2.21½
Granite	.67
Isabella	.19
Jack Pot	.06
Jerry Johnson	‡.05
Mary McKinney	.42
Portland	1.33½
Vindicator	2.43

TORONTO	May 16
Bailey	.08
Chambers Ferland	.29
Coniagas	5.25
La Rose	.62½
Peterson Lake	.31
Right of Way	.05
Seneca Superior	.50
T. & Hudson Bay	33.00
Temiskaming	.73
Trethewey	.29
Wettlaufer-Lor	.09
Dome Exten.	.34
Dome Lake	.24
Foley O'Brien	.50
Hollinger	30.00
Imperial	.03½
Jupiter	.24
McIntyre	1.62½
Porcu. Crown	.62½
Preston E. D.	.04
Vipond	.52
West Dome	.29

N. Y. EXCH. Name of Comp.	May 16 Clg.
Alaska Gold M.	22⅛
Alaska Juneau	9⅜
Am.Sm.&Ref.,com	99⅛
Am. Sm. & Ref., pf.	113
Am. Sm. Sec., pf. A	94
Am. Sm. Sec., pf. B	86⅛
Am. Zinc	91½
Anaconda	84⅛
Batopilas Min.	2½
Bethlehem Steel	445
Bethlehem Steel, pf.	135
Butte & Superior	96
Chile Cop.	21⅛
Chino	54
Colo. Fuel & Iron	43⅛
Crucible Steel	86
Dome Mines	28⅛
Federal M. & S.	17
Federal M. & S., pf.	38
Great Nor., ore ctf.	41⅛
Greene Cananea	48⅛
Homestake	129
Inspiration Con.	45½
International Nickel	47
Kennecott	56½
Lackawanna Steel	71⅛
Miami Copper	36⅛
Nat'l Lead, com.	68½
National Lead, pf.	116
Nev. Consol.	17½
Ontario Min.	9⅛
Quicksilver	3⅛
Quicksilver, pf.	4
Ray Con.	23⅛
Republic I&S, com.	49
Republic I&S, pf.	109⅛
Sloss-Sheffield	55½
Sloss-Sheffield, pf.	95
Tennessee Copper	47½
Utah Copper	80⅛
U. S. Steel, com.	84⅛
U. S. Steel, pf.	117
Va. Iron C. & C.	52

N. Y. CURB Name of Comp.	May 16 Clg.
Adanac	.65
Alta Con.	.62
Beaver Con.	.47
Buffalo Mines	1⅛
Butte & N. Y.	2⅛
Butte C. & Z.	7⅛
Can. Cop. Corpn.	2½
Cashboy	.08
Cerro de Pasco	38
Con. Ariz. Sm.	1⅛
Con. Coppermines	3
Con. Nev.-Utah	.34⅛
Dia. Black B.	.06
First Nat. Cop.	5⅛
Florence	.48
Goldfield Con.	1
Goldfield Merger	.12
Granite	.51
Hecla Min.	4⅛
Howe Sound	6⅛
Jerome Verde	2 7/16
Kenefick Zinc	14
Kerr Lake	4 13/16
Magma	17
Majestic	.75
McKinley-Dar-Sa.	.65
Mines of Am.	2⅛
Mother Lode	.32½
Nevada Hills	.21
New Utah Bingham	‡2⅛
Nipissing Mines	7⅛
Oro	.05
Ray Hercules	4⅛
Rochester Mines	.68
St. Joseph Lead	17
Standard S. L.	1 11/16
Stewart	⅛
Success	.76
Tonopah	6⅛
Tonopah Ex.	6 3/16
Tribullion	1/16
White Knob, pf.	‡1⅛
Yukon Gold	2⅛

BOSTON EXCH Name of Comp.	May 16 Bid
Adventure	3⅛
Ahmeek	400
Algomah	.85
Allouez	70
Ariz. Com., ctfs.	9⅛
Bonanza	.37
Butte-Ballaklava	2⅛
Calumet & Ariz.	74⅛
Calumet & Hecla	562
Centennial	17
Copper Range	67⅛
Daly West	3
East Butte	12½
Franklin	8½
Granby	89½
Hancock	14½
Hedley	‡20
Helvetia	.35
Indiana	3⅛
Island Cr'k, com.	51½
Island Cr'k, pfd.	90
Isle Royale	29
Keweenaw	6½
Lake	17½
La Salle	4½
Mason Valley	3⅛
Mass	13½
Mayflower	3½
Michigan	3½
Mohawk	97
New Arcadian	7½
New Idria	13½
North Butte	24⅛
North Lake	1
Ojibway	2
Old Colony	2⅛
Old Dominion	70⅛
Osceola	95½
Quincy	97½
St. Mary's M. L.	75½
Santa Fe	2⅛
Shannon	8⅛
Shattuck-Ariz.	32
So. Lake	‡7½
So. Utah	‡.30
Superior	17⅛
Superior & Bost.	5⅛
Tamarack	53⅛
Trinity	7½
Tuolumne	.48
U. S. Smelting	76½
U. S. Smelt'g, pf.	51⅛
Utah Apex	4 13/16
Utah Con.	14⅛
Utah Metal	9⅛
Victoria	3½
Winona	4⅛
Wolverine	58½
Wyandot	1⅛

BOSTON CURB Name of Comp.	May 16 Bid
Bingham Mines	14⅛
Boston Elv.	.55
Boston & Mont.	1⅛
Butte & Lon'n Dev.	.83
Calaveras	4⅛
Calumet-Corbin	.05
Chief Con.	2 7/16
Cortez	.60
Crown Reserve	.58
Davis-Daly	1⅛
Eagle & Blue Bell	2 7/16
Houghton Copper	2
Iron Cap Cop., pf.	7
Mexican Metals	.40
Mojave Tungsten	7⅛
Nat. Zinc & Lead	2⅛
Nevada-Douglas	1
New Baltic	2⅛
New Cornelia	14⅛
Ohio Copper	.18
Oneco	1
Raven Copper	.18
Rex Cons.	.29
Rilia	.80
United Verde Ext.	26⅛

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	.....	26.704	23.570	.....
June	56.471	49.034	.....	25.948	23.267	.....
July	54.678	47.519	.....	25.219	22.597	.....
August	54.344	47.163	.....	25.979	22.780	.....
September	53.290	48.680	.....	24.260	23.591	.....
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	.....	22.703	25.094	.....
December	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	.....	77.600	.....	*	.....
June	19.477	.....	82.574	.....	95.333	.....
July	18.796	.....	76.011	.....	91.409	.....
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York 1915	New York 1916	London 1915	London 1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	.....	162.675	.....
June	40.288	.....	167.636	.....
July	37.423	.....	167.080	.....
August	34.389	.....	151.440	.....
September	33.125	.....	152.625	.....
October	33.080	.....	151.554	.....
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

LEAD

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	.....	4.182	.....	20.347	.....
June	5.932	.....	5.836	.....	25.170	.....
July	5.659	.....	5.531	.....	24.611	.....
August	4.656	.....	4.520	.....	21.946	.....
September	4.610	.....	4.490	.....	23.151	.....
October	4.600	.....	4.499	.....	23.994	.....
November	5.155	.....	5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	.....	14.610	.....	68.100	.....
June	21.208	.....	21.038	.....	100.614	.....
July	19.026	.....	18.856	.....	97.250	.....
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	.....	13.60	.....	13.83	.....
June	14.70	.....	13.67	.....	13.77	.....
July	14.94	.....	13.91	.....	13.68	.....
August	16.01	.....	15.31	.....	14.75	.....
September	16.86	.....	15.95	.....	15.70	.....
October	16.95	.....	15.96	.....	15.80	.....
November	17 57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.